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MATERIALS SCIENCE AND METALLURGY

No. 42

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MATERIALS SCIENCE AND METALLURGY

No. 42

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CONTENTS	PAGE
Aluminum and Its Alloys	1
Coatings	4
Composite Materials	5
Conferences	15
Corrosion	17
Forming	21
Heat Treatment	23
Instrumentation and Equipment	24
Mechanical Properties	26
Powder Metallurgy	27
Single Crystals	32
Steels	33
Superalloys	35
Thermomechanical Treatment	36
Thin Films	37
Titanium	38
Welding	42
Miscellaneous	43

Aluminum and Its Alloys

USSR

UDC 669.715:621.74

CASTING LARGE INGOTS OF D16 AND V95 ALLOYS

Moscow TSVETNYYE METALLY in Russian No 11, Nov 76 pp 56-58

MALINOVSKIY, R. R. and SILAYEV, P. N.

[Abstract] An account of the progress that has been made since 1950 in increasing the mass of ingots cast from D16 and V95 high-strength aluminum alloys, which have a high inclination to crack formation as ingot dimensions increase. The greatest improvement in casting technique has been achieved by special mixing of the charge with a sharp reduction in the content of impurities that influence crack formation (chiefly silicon). In addition, modern methods of refining to remove hydrogen and oxide particles are used, resulting in an increase in mass from 2-3 tons in 1950 to 8-11 tons in 1975-1976. The dimensions of D16 ingots have increased from 250 x 800 x 500 mm in 1950-1955 to 550 x 1460 x 800 mm in 1975-1976. The corresponding figures for V95 alloy are 370 mm in diameter and length of 5-6 m in 1950-1955 to 400 x 1200 x 750 mm in 1975-1976. It should be possible to increase ingot size to 550 x 2000 x 950 mm for D16 alloy and to 400 x 1700 x 800 mm for V95.

USSR

UDC 669.715:539.374 620.172:548.4

EFFECT OF SOME FACTORS ON THE PORTEVIN-LE CHATELIER EFFECT IN ALUMINUM ALLOYS

Ordzhonikidze IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIYE, TSVETNAYA METALLURGIYA in Russian No 5, 1976 pp 105-110, manuscript received 8 Dec 75

KRAVCHENKO, V. E., KOLACHEV, B. A., GABIDULLIN, P.M., Moscow Aviation Technological Institute, Chair of Physical Metallurgy and Heat Treatment of Metals

[Abstract] A study was made of the effect of chemical composition, hydrogen absorption, and test conditions on the parameters of the Portevin-Le Chatelier effect in aluminum alloys. Specimens of aluminum alloys containing various alloying elements were tested for intermittent deformation at 173-398°K. It was found that the Portevin-Le Chatelier effect appears in aluminum alloyed with elements whose atomic radius differs by more than 10% from the atomic radius of aluminum. It was also found that the amplitude of jumps depends on the test conditions and the structure and chemical composition of the alloy. Hydrogen absorption facilitates the development of intermittent

deformation. It is assumed that the effect of hydrogen on the character of intermittent deformation is connected with the effect of hydrogen on the diffusion mobility of atoms of the alloying elements. Figures 5; references 15: 7 Russian and 8 Western.

USSR

UDC 620.194.810

CORROSION-FATIGUE DURABILITY OF ANODIZED ALUMINUM ALLOYS

Kiev FIZIKO-KHIMICHESKAYA MEKHANIKA MATERIALOV in Russian Vol 12, No 5, Sep-Oct 76 pp 99-101 manuscript received 18 Mar 75

KARLASHOV, A. V., GAYNUTDINOV, R. G. and GOLUBNICHYIY, A. V., Kiev Institute of Civil Aviation Engineering

[Abstract] Results are presented from a study of the influence of various substances introduced to a sulfate electrolyte on the corrosion-fatigue durability of aluminum alloys and the stress in the anode film. A table presents the values of corrosion-fatigue durability of the specimens tested. It shows that the corrosion-fatigue rupture resistance of aluminum alloys anodized in electrolytes with added thiocarbamide, sulfosalicylic acid and potassium-sodium tartrate is higher, while benzonitrile causes this figure to be lower than that of alloys anodized in an electrolyte without any additives. The strengthening effect is attributed to a drop in the stress in the surface layers of the film, while those additives which reduce strength are found to increase this stress. 5 references.

USSR

UDC 669.15.782-172.620.191.33

STRUCTURE AND RUPTURE VISCOSITY OF ALUMINUM ALLOYS

Kiev FIZIKO-KHIMICHESKAYA MEKHANIKA MATERIALOV in Russian Vol 12, No 5, Sep-Oct 76 pp 38-41 manuscript received 16 Jul 75

TELESHOV, V. V. and KUDRYASHOV, V. G., All-Union Institute of Light Alloys, Moscow

[Abstract] A study is made of the influence of chemical composition and structural parameters of pressed semifinished goods of the alloys V93, V95 and V96ts on the rupture viscosity in order to establish the quantitative dependences between K_{Ic} (the measure of crack resistance of structural materials), the content of alloying elements and structural parameters.

The use of linear set regression equations (considering chemical composition) allows a significant increase in the accuracy of prediction of viscosity K_{1c} . The equations produced are $K_{1c} = 146.1 - 11.36 Q - 14.75$ (Mg, %) - 41.61 (Fe, %) in the direction of height; $K_{1c} = 150.36 - 6.98 Q - 21.5$ (Mg, %) - 48.69 (Fe, %) + 47.64 (Si, %) + 22.25 (Mn + Cr + Zr, %) + 0.206 $\cdot\ell$ in the transverse direction. 10 references.

Coatings

USSR

UDC 620.198

COMPOSITE ZINC-BASED COATINGS

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 6, Nov-Dec 76 pp 731-732
manuscript received 13 Jan 75

ANDRYUSHCHENKO, YU. I. and KOZLOVA, L. A., Rostov-on-Don Scientific
Research Institute for Machine Building Technology

[Abstract] This work is dedicated to the precipitation of coatings based on zinc and containing silicon carbide and other hard particles. Specimens of type 3 steel were covered in a galvanizing electrolyte developed in the USA allowing operation at high current density without colloidal additives. The electrolyte consisted of 300 g/l zinc sulfate, 30 g/l ammonium chloride, 15 g/l aluminum sulfate and 4 g/l sodium phosphide, pH 4-4.5, current density 2.65-21.5 a/dm², optimal 3-5 a/dm². The tests showed that pure zinc coatings corrode in the same manner as those containing 7% silicon carbide. The corrosion of coatings with 10% silicon carbide is slight greater. 4 references.

Composite Materials

USSR

UDC 621.762

COMPOSITION MATERIALS BASED ON GLASS-CERAMIC

Kiev POROSHKOVAYA METALLURGIYA in Russian No 11(167), Nov 76 pp 81-83 manuscript received 4 Feb 74

BELOBORODOV, I. I., YUGA, A. I., NAZARENKO, N. D., KOLESNICHENKO, L. F. and VLASKO, N. I., Institute of Problems in the Science of Materials, Academy of Sciences UkrSSR

[Russian abstract provided by the source]

[Text] A material is described for making bearings with high corrosion resistance that operate in friction couples of some chemical equipment. The authors demonstrate the feasibility of making a porous composition material based on metal and glass-ceramic. Porous specimens are made by introducing a rock-forming substance; the amount of this agent determines the porosity of the matrix, and fluctuates between 15 and 50%. The matrix is permeated with Teflon in a vacuum chamber. The resultant composition material has excellent antifriction properties. References 5 Russian.

USSR

UDC 669-419.4

EUTECTOID COMPOSITES

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 11, 1976 pp 54-57

SOMOV, A. I. and TIKHONOVSKIY, M. A., Physics and Technology Institute of Academy of Sciences UkrSSR, Khar'kov

[Abstract] A study is made of the regularities of formation and strength of oriented Cu-Al and Co-Si eutectoid composites. The alloys of eutectoid composition Cu-11.8% Al and Co-13.7% Si were produced by directed crystallization so that the heat flux in the crystal was primarily axial rather than radial. The formation of eutectoid composites with oriented microstructure occurs only if the rate of extraction is less than a certain critical rate R_{max} . The degree of dispersion of phases in eutectoid composites depends on the extraction rate. The complex nature of this dependence reflects the change in mechanisms controlling eutectoid decomposition. Eutectoid compositions have high strength limit, increasing with increase rate of extraction. 8 references.

USSR

UDC 669.718:658.562

INFLUENCE OF OXYGEN IN IRON ON INHIBITION OF REACTIVE DIFFUSION IN Al-Fe
BIMETALLIC COMPOSITES

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 11,
1976 pp 51-54

ZHELADNOV, V. I., MAKUNIN, M. S. and ARZHANYY, P. M., Institute of Metallurgy
imeni A. A. Baykov

[Abstract] The determination of an effective method for suppressing the formation of brittle intermetallides in the transition zone of iron-aluminum bimetallic composites during their manufacture is necessary if new materials are to be developed combining the properties of the two metals. Laboratory studies were performed on specimens of high-purity iron with oxygen content 0.002, 0.033 and 0.11%, and low contents of other impurities as well. The cladding material used was a standard alloy type A99 based on aluminum with 1.0-1.5% Si, 0.1-0.7% Fe and not over 0.1% Zn and 0.1% Cu. It is found that in heat treatment of bimetallic aluminum-iron composites, reactive diffusion can be suppressed by the oxygen contained in the steel base as a result of formation of a film of aluminum oxide at the division boundary between the metals, blocking mass transfer of both components. This can be used in cladding steel with aluminum and its alloys by cold joint rolling with subsequent recrystallization annealing. 8 references.

USSR

UDC 678.067.5:539.4

ANALYSIS OF METHODS FOR DETERMINING THE INTERLAMINAR SHEAR STRENGTH OF
COMPOSITE MATERIALS

Riga MEKHANIKA POLIMEROV in Russian No 4, 1976 pp 640-648 manuscript
received 3 Jun 75

ZHIGUN, I. G., YAKUSHIN, V. A., and IVONIN, YU. N., Institute of Polymer
Mechanics, Academy of Sciences Latvian SSR, Riga

[Abstract] There is established the range of geometrical dimensions of a specimen, in which the values of interlaminar shear strength determined by four of the five considered methods virtually do not change. It has been found that the experimental data obtained by the method of the three-point flexure of short beams do not characterize the interlaminar shear strength of the beams. It is shown that the interlaminar shear strength of fiberglass-reinforced plastic, and the shear strength of the binder on the basis of which the plastic is produced, are very close with respect to value. Figures 8; tables 2; references 8: 5 Russian and 3 Western.

USSR

UDC 678.067.5:539.4

THE INITIAL STRENGTH SURFACE OF A UNILATERALLY REINFORCED COMPOSITE DURING A PLANE STRESSED STATE

Riga MEKHANIKA POLIMEROV in Russian No 4, 1976 pp 633-639 manuscript received 7 Jul 75

RIKARDS, R. B. and CHATE, A. K., Institute of Polymer Mechanics, Academy of Sciences Latvian SSR, Riga

[Text] [Russian abstract provided by the source] The initial strength surfaces of a unilaterally reinforced composite during a plane stressed state are determined on the basis of the strength of the reinforcing fibers and the binder. The microstresses in the components are determined according to the method of finite elements. For assessing the strength of the polymer binder, which is in a volumetric stressed state, there is proposed a condition of strength in the form of a high-order polynomial of three stress invariants. The Mises criterion is used for the reinforcing fibers. Figures 4; references 5: 4 Russian and 1 Western.

USSR

UDC 546.284'261:546.273'171

POLYMORPHIC CONVERSIONS IN THE SiC-BN COMPOSITION

Moscow IZVESTIYA AKADEMII NAUK SSSR, NEORGANICHESKIYE MATERIALY in Russian Vol 12, No 10, 1976 pp 1877-1878 manuscript received 17 Feb 75

SOKHOR, M. I. and FEL'DGUN, L. I., All-Union Scientific Research Institute of Abrasives and Grinding

[Abstract] There are investigated the structural changes and polymorphic conversions in the SiS-BN composition subjected to the action of high pressures and temperatures. The experiments were conducted on SiC and BN micropowders in hexagonal and cubic modifications of technical purity. The components were mixed in a ratio of 1:1 and were subjected for 3 minutes to the action of a pressure of approximately 55 kilobars at a temperature of 1250-1850°C in a static high pressure installation designed by the Institute of High-Pressure Physics, USSR Academy of Sciences. Tables 1; references 8: 4 Russian and 4 Western.

USSR

UDC 678.067.5:536.6

CONCERNING TEMPERATURE DISTRIBUTION IN THE COMPONENTS OF COMPOSITES OF THE FIBERGLASS PLASTIC TYPE

Riga MEKHANIKA POLIMEROV in Russian No 5, Sep/Oct 76 pp 825-830 manuscript received 12 Oct 74

VOLKOV, S. D. and LAPSHINA, I. F., Ural Polytechnical Institute imeni S. M. Kirov, Sverdlovsk

[Abstract] Previous research has shown that in materials of polycrystalline structure with low dispersion of coefficients of thermal conduction, the dispersion of random temperature of a polycrystal grain approaches zero as the characteristic dimension of the grain approaches zero. Because of this temperature equalizing effect, fine-grained polycrystals are more reliable as structural elements where temperature distribution is uneven. In this paper an analogous effect is established for composites of the fiberglass plastic type. The deduced property is illustrated by a numerical example of a chaotically reinforced (macroscopically isotropic) fiberglass plastic with isotropic components. The properties of the components differ by a factor of more than 6, temperature is unevenly distributed, and the random temperature dispersion in the material is shown to be close to zero.

References 6 Russian.

USSR

UDC 678.067.5:539.4

DESTRUCTION OF COMPOSITE MATERIALS BY PEELING APART

Riga MEKHANIKA POLIMEROV in Russian No 5, Sep/Oct 76 pp 918-922 manuscript received 10 Nov 75

KACHANOV, L. M., Leningrad State University imeni A. A. Zhdanov

[Russian abstract provided by the source]

[Text] The destruction of materials of the laminar or fibrous type may occur by peeling. The cause of peeling under compression is local loss of stability accompanied by rupture of the binder. General problems of peeling and some special problems are examined on the basis of an energy criterion. It is shown that there is a minimum stress and preferred thickness for peeling apart. An examination is made of peeling of rods under compression and bending, and compression of a plate. References 2 Russian.

USSR

UDC 666.762.81.001.5

AN INVESTIGATION OF VARIOUS PROPERTIES OF COMPOSITIONS CONTAINING GRAPHITE AND REFRACTORY COMPOUNDS

Moscow OGNEUPORY in Russian No 11, 1976 pp 53-58

PETROV, YU. N., KUL'VARSKAYA, B. S., KAN, KH. S., and MALAKHOVA, V. A., Institute of Radio Technology and Electronics, Academy of Sciences USSR

[Abstract] Tests were conducted with a compound containing graphite, silicon and zirconium diboride, included respectively for their qualities of heat durability and electrical conductivity, mechanical durability, and resistance to corrosion. The alloy, designated EGS-40, was then tested for oxidation and corrosion using heat radiation by natural convection into the air at temperatures of 1200, 1600 and 1800°C for ten minutes. The temperature of specimens was measured optically. Results indicated much lower oxidation rates than commercially available materials based on graphite. The level of concentration of the heat current through an electrode had no relation to the corrosion rate. The electrode surface became covered with a coating composed of the oxides of the additives used in the alloy, boron, silicon and zirconium. The composition tested proved to have positive features of electrical resistance and high emission capabilities, with little sensitivity to temperature variations. Thus the compound EGS-40 might serve efficiently as an electrode material or as a heating element. In addition, the materials needed to produce the alloy are available domestically. Figures 6; tables 2; references 12, all Russian.

USSR

UDC 678.067.5:539.319

FORMATION OF RESIDUAL STRESSES DURING THE HARDENING PROCESS IN ARTICLES MADE FROM LAMINAR AND FIBROUS COMPONENTS

Riga MEKHANIKA POLIMEROV in Russian No 5, Sep/Oct 76 pp 790-794 manuscript received 23 Oct 75

BOLOTIN, V. V. and VORONTSOV, A. N., Moscow Power Engineering Institute

[Russian abstract provided by the source]

[Text] The theory of viscoelasticity of unstable media is taken as the basis in studying the process of formation of residual stresses in filament-wound laminates of composition materials. Structures are examined in the form of solids of revolution made from unidirectional and laminar plastics based on a hardening binder. A comparison is made of the contribution of chemical and thermal shrinkage to the formation of residual stresses. The authors discuss the influence that the cooling schedule has on the development of residual stresses, the nature of interaction between workpiece and mandrel and the cracking resistance of finished items. Results on different types of fiberglass plastics are compared. References 9 Russian.

USSR

UDC 678.067.5:539.4

DETERMINING THE RELIABILITY OF A FIBERGLASS-REINFORCED PLASTIC COMPOSITE

Riga MEKHANIKA POLIMEROV in Russian No 5, Sep/Oct 76 pp 796-799 manuscript received 19 Jul 74

ROGINSKIY, S. L., KANOVICH, M. Z. and KOLTUNOV, M. A., All-Union Scientific Research Institute of Fiberglass and Fiberglass-Reinforced Plastics, Moscow Institute of Electronic Machine Building

[Abstract] The problem of determining the reliability of a fiberglass plastic composite is formulated in terms of the probability that conditions of monolithism will be met during the period of utilization, assuming that the elastic-strength characteristics of the composite are random quantities. The conditions of integrity (monolithism) take the form $u_i = x_i - y_i \geq 0$, $i = 1, 2, \dots, N$, where x_i , y_i are the elastic-strength characteristics of the binder and reinforcement respectively. An expression is found for the simultaneous satisfaction of all conditions assuming normal distribution of the vector (u_1, u_2, \dots, u_N) . Both steady-state and time-dependent characteristics are considered. References 5 Russian.

USSR

UDC 678.067.5:539.4

MATHEMATICAL MODELING OF PROCESSES OF DESTRUCTION OF COMPOSITE MATERIALS REINFORCED WITH BRITTLE FIBERS

Riga MEKHANIKA POLIMEROV in Russian No 5, Sep/Oct 76 pp 800-808 manuscript received 16 Sep 74

OVCHINSKIY, A. S., NEMTSOVA, S. A. and KOP'YEV, I. M., Institute of Metallurgy imeni A. A. Baykov, Academy of Sciences USSR, Moscow

[Russian abstract provided by the source]

[Text] A technique is worked out for mathematical modeling of processes of destruction of materials reinforced by fibers that have considerable scatter of strength properties. An investigation is made of the transition from the stage of static accumulation of damage to complete fracture of the material. A model is constructed for the avalanche process of destruction of fibers in the material caused by overloads as a result of breaking of individual fibers. An examination is made of the influence that the relation between properties and volumetric percentages of components as well as the initial statistical distributions of the strength of fibers have on the processes of destruction of composite materials. Diagrams of deformation of composite materials plotted on the basis of an analysis of the modeled process of destruction of fibers in the composite agree satisfactorily with the experimental data in the literature. References 8: 5 Russian, 3 Western.

USSR

UDC 678.067.5:539.4

ON PREDICTING BRITTLE FRACTURE OF COMPOSITE MATERIALS

Riga MEKHANIKA POLIMEROV in Russian No 5, Sep/Oct 76 pp 809-814 manuscript
received 1 Oct 74

STAVROV, V. P. and TITENOK, V. I., Gomel' State University

[Russian abstract provided by the source]

[Text] A method is proposed for solving statistical boundary value problems of elasticity theory of composite materials with defects of the pore type. The results are applied to prediction of the fracture process and brittle strength of composite materials. Tensile diagrams are plotted and tensile strength values are calculated from the predetermined properties of the components for randomly reinforced and unidirectional materials. References 14 Russian.

USSR

UDC 678.067.5:539.2

KINETICS OF DESTRUCTION OF MODEL COMPOSITIONS WITH MODIFIED REINFORCING FIBERS

Riga MEKHANIKA POLIMEROV in Russian No 5, Sep/Oct 76 pp 815-818 manuscript
received 8 Jul 75

REGEL', V. R., LEKSOVSKIY, A. M., ORLOV, L. G., LEKSOVSKAYA, N. P., MAZO, A. I. and PEREPELKIN, K. YE., Physicotechnical Institute imeni A. F. Ioffe, Academy of Sciences USSR, Leningrad Affiliate of the All-Union Scientific Research Institute of Artificial Fiber

[Russian abstract provided by the source]

[Text] Infrared spectroscopy shows that a chemical "cross-linkage" is formed between polyvinyl alcohol reinforcing fibers and epoxy matrix via bifunctional diisocyanate molecules that carry an appreciable fraction of the load applied to the model composite specimen. It is shown that the substitution of a chemical bond for weak intermolecular interaction between reinforcement and matrix leads to more effective loading of the reinforcing fibers through the matrix, increases strength and durability and also reduces peeling apart of the composite material. References 7 Russian.

USSR

UDC 678.067.5:546.27

INVESTIGATION OF THE PHYSICOMECHANICAL PROPERTIES OF BORON FILAMENTS OF DIFFERENT DIAMETERS

Riga MEKHANIKA POLIMEROV in Russian No 5, Sep/Oct 76 pp 819-824 manuscript received 25 Sep 74

ROSHKOVAN, G. L., ZHIGACH, A. F., SAMOSUDOV, P. A., TSIRLIN, A. M., SHCHE-TILINA, YE. A., KHODOV, G. YA. and D'YACHKIN, YE. K., Special Technological Design Office of Recording Equipment, Kishinev

[Russian abstract provided by the source]

[Text] The paper gives the results of an investigation of the physical and mechanical properties of boron filaments (average strength, coefficient of strength variation, elastic limit, normal elastic modulus, shear modulus, and resistivity at room temperature) as a function of filament diameter. It is shown that shear modulus and resistivity increase with diameter, while the remaining characteristics are practically independent of diameter. Boron filaments of all diameters showed high stability of properties under high-frequency cyclic twisting (20,000 Hz, $7.8 \cdot 10^{10}$ cycles over a period of 1000 hours [sic]) with heating to 150°C and storage at 20°C in air and in polymethylsiloxane liquid for 24 months. Maximum twist reached 35 radians. References 8 Russian.

USSR

UDC 621.763:669-494(088.8)

A METHOD OF MAKING A FIBER-REINFORCED COMPOSITE MATERIAL

USSR AUTHOR'S CERTIFICATE No 1956864, Division B, filed 13 Aug 73, published 6 Feb 76

GUNYAYEV, G. M., DUSHIN, M. I., CHUBAROV, V. M., BELOZEROV, L. G. and TUMANOV, A. T.

[From REFERATIVNYY ZHURNAL, METALLURGIYA No 10, 1976 Abstract No 10G410P]

[Text] The method involves application of a metal coating to the fibers, layering the fibers in a stack with aluminum foil and hot-pressing. To increase strength, the foil is laid on separate sections of fibers, and the material is saturated with a heat-resistant organic binder after hot-pressing.

USSR

UDC 669.3.018.9+669.27.018.9

PRODUCTION OF A FILAMENTARY COPPER-TUNGSTEN COMPOSITE

IZVESTIYA VORONEZHSGO GOSUDARSTVENNOGO PEDAGOGICHESKOGO INSTITUTA in
Russian No 151, 1976 pp 41-43

POGORELOV, V. G. and KOROTAYEV, YE. A.

[From REFERATIVNYY ZHURNAL, METALLURGIYA No 10, 1976 Abstract No 10I599 by
V. Bochkareva]

[Text] A method is proposed for making a filamentary Cu-W composite that
can be used to produce thin specimens in the form of rods with a large ratio
of length to diameter. The technique is based on infiltration impregnation.
The procedure suggested for making the specimens is described. Figures 2,
reference 1.

USSR

UDC 621.762.5.001.27

INVESTIGATION OF THE KINETICS OF SINTERING TUNGSTEN-IRON-NICKEL COMPOSITE
MATERIAL

Tula TEKHOLOGIYA MASHINOSTROYENIYA [Machine Building Technology, Collection
of Works] in Russian No 4, 1975 pp 85-89

LERNER, M. I., ANDREYEVA, I. B. and SOZINA, A. L.

[From REFERATIVNYY ZHURNAL, METALLURGIYA No 10, 1976 Abstract No 10G355 by
the authors]

[Text] Methods of metallographic and x-ray structural analysis are used to
study the kinetics of sintering a composite material containing 90% W,
7% Ni and 3% Fe (sintering temperature 1400°C, sintering time 0.5, 2, 4 and
8 hours). The optimum structure is formed with sintering for 4 hours.

USSR

UDC 621.762(02)

POWDER AND COMPOSITE MATERIALS

Moscow POROSHKOVYYE I KOMPOZITSIONNYYE MATERIALY in Russian, "Nauka," 1976,
128 pp

TSUKERMAN, S. A.

[From REFERATIVNYY ZHURNAL, METALLURGIYA No 10, 1976 Abstract No 10G407K
(résumé)]

[Text] The book describes materials produced by powder metallurgy from metal powders and metal fiber. An examination is made of the manufacturing technique and the specific unique properties of powder and composite materials and items made from them. The advantage of powder metallurgy methods from the standpoint of technical and economic feasibility is demonstrated.

USSR

UDC 546.284:546.817-31:546.863-31+546.35'151+546.36'131

MICRON-DIAMETER COMPOSITION GLASS THREADS WITH A SALT CORE

Moscow IZVESTIYA AKADEMII NAUK SSSR, NEORGANICHESKIYE MATERIALY in Russian
Vol 12, No 10, 1976 pp 1900-1901 manuscript received 27 Jan 75

PTITSYNA, N. P., FARMAKOVSKIY, B. V., FEOFANOVA, T. A., and KHUDOLEYEV, A. G.

[Abstract] Threads of $SiO_2-PbO-Sb_2O_3$ glass, up to 15,000 m long, with an outer diameter of 20-100 microns and an inner diameter of 6-60 microns and a salt core of RbI and CsCl, have been obtained on a high-frequency installation. The threads have a round cross section. Figures 1; references 2: 1 Russian and 1 Western.

Conferences

USSR

SCIENTIFIC AND TECHNICAL SEMINAR "AUTOMATION AND MECHANIZATION OF FORGING AND STAMPING PRODUCTION"

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 8, 1976 p 47

YEKIMOV, K. K., STEL'MAKOV, S. M., and SILICHEV, A. N.

[Abstract] The scientific and technical seminar "Automation and Mechanization of Forging and Stamping Production" was conducted in the Leningrad area on 7-8 October 1975. Participating in it were representatives of enterprises, scientific research institutes, and higher educational institutions of Leningrad, as well as of Moscow, Gor'kiy, Minsk, Voronezh, Khar'kov, Zaporoz'ye, Izhevsk, Kramatorsk, and other cities. The 16 lectures and reports delivered at the seminar dealt with the present state, improvement, and prospects of the development of processes of automation and mechanization in forging and stamping production.

USSR

ALL-UNION SCIENTIFIC SEMINAR "THE SUPERPLASTICITY OF METALS"

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 8, 1976 p 48

OKHRIMENKO, YA. M., Doctor of Technical Sciences, Professor, Chairman of the Council on the Problem of "Utilization of Superplasticity in Processes of Metal Machining by Pressure" and TSEPIN, M. A., Scientific Secretary of the Organization Committee of the Seminar, Candidate of Technical Sciences

[Abstract] On the initiative of the Council on the problem of "Utilization of Superplasticity in Processes of Metal Machining by Pressure," the Ministry of High and Secondary Special Education, the Central Administration of the Scientific and Technical Society of the Machinery Industry, and Central Scientific Research Institute on Information organized, in January 1976, at the Moscow Institute of Steel and Alloys an all-Union seminar devoted to the theory and practice of the machining of superplastic materials. Present at the Seminar were 336 scientists and engineers from 30 Soviet cities and from 25 higher educational institutions, four academic institutes, 43 branch scientific research institutes, and 19 machine-building plants.

USSR

SCIENTIFIC AND TECHNICAL SEMINAR "NEW DEVELOPMENTS IN METALLOGRAPHY AND HEAT TREATMENT"

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 11, 1976 pp 78-79

SMIRNOV, M. A.

[Abstract] On 15-16 April 1976, the seminar mentioned in the title was held in Chelyabinsk. Representatives of 56 enterprises and 26 scientific research and educational institutions from 43 cities of the USSR attended the seminars. Some 32 reports were heard and discussed, on the following subjects: problems of the theory of heat treatment; new achievements in stainless steels and spring materials; means for increasing the workability of structural steel; problems of their phase and structural recrystallization; kinetics of rupture of iron and its alloys; problems of alloying and improvement of heat treatment of stainless and heat-resistant steels and alloys; the influence of the technology of heat treatment on the properties of heat resistant austenitic steels; the grain structure of heat-resistant steel; the theory of phase transformations occurring during heat treatment; the use of foam media in hardening of metal products; increasing the wear resistance of steel; combined methods of hardening of steels and alloys; and the influence of mechanical and heat treatment on the heat resistance of pearlitic thermally stable steel. 18 references.

USSR

THIRD INTERNATIONAL CONFERENCE ON TITANIUM

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 6, Nov-Dec 76 pp 747-748

TOMASHOV, N. D., FOKIN, M. N. and RUSKOL, YU. A.

[Abstract] The Third International Conference on Titanium, held in Moscow 18-21 May 1976, involved the AIME, American Metallurgical Society and the Japanese Institute of Metals, and was attended by 500 participants from 16 countries. The program of the conference, prepared by the international organizing committee, included over 200 reports, grouped in 13 sections: 1. Development of the production and application of titanium. 2. Production of metallic titanium. 3. Ingots and complex castings. 4. Pressure working of titanium and its alloys. 5. The mechanism of plastic deformation: superplasticity, strength and rupture. 6. Welding and quality control. 7. Phase diagrams; electron and crystalline structure; physical properties. 8. Phase transformations in titanium alloys and the technology of heat and heat and mechanical treatment. 9. Influence of technological factors on the structure and properties of titanium alloys. 10. Powder metallurgy of titanium. 11. Composite materials with titanium matrices; production of semifinished goods by the method of vacuum evaporation. 12. Corrosion and oxidation. and 13. Titanium alloys for various branches of technology. A few of the reports are very briefly summarized.

Corrosion

USSR

UDC 620.193:669.292'295'6

THE CORROSION RESISTANCE AND SOME PHYSICAL AND MECHANICAL PROPERTIES OF ALLOYS OF VANADIUM WITH TITANIUM AND TIN

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 10, 1976 pp 53-56

MARCHUKOVA, L. V., TUMANOVA, T. A., MATVEYEVA, N. M., and KORNILOV, I. I., Institute of Metallurgy imeni A. A. Baykov

[Abstract] Investigation of the corrosion resistance of binary alloys of vanadium with titanium in 18% HCl at room temperature and the influence of tin, introduced into the alloys as a strengthening additive, on their corrosion resistance, showed that vanadium and binary alloys of vanadium with titanium (less than 50% Ti) possess high corrosion resistance in this medium at room temperature, titanium decreasing the rate of vanadium corrosion, whereas the corrosion resistance of ternary V-Ti-Sn alloys is determined by the proportion of tin and titanium in them. The corrosion rate of alloys with 30% titanium, containing up to 7.5% Sn, is less than 0.01 mm/year, i.e., considerably lower than that of pure vanadium. The electrical resistance and strength of vanadium are increased considerably by the introduction of titanium and tin. Alloys containing up to 5% Sn and up to 50% Ti have high corrosion resistance in 18% HCl, and possess adequate plasticity, high strength properties, and low density (5.3-6.2 g/cm³). Figures 2; references 12: 10 Russian and 2 Western.

USSR

UDC 620.198

CORROSION BEHAVIOR OF DIFFUSION TITANIUM COATINGS IN SEA WATER

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 6, Nov-Dec 76 pp 704-706
manuscript received 24 Feb 75

KURIS, V. P., KIRIYENKO, L. A., and BAZILEVICH, T. P.

[Abstract] Titanium alloys were tested in natural sea water. Diffusion coatings of titanium and its combinations with other elements were applied by vacuum and powder methods, and also by spreading titanium hydride with furnace heating and with induction heating onto cylindrical specimens 15 mm in diameter, 40 mm long, made of types 20, 35Kh and 38KhA steels. The diffusion titanium coatings studied in sea water did not provide complete protection of the steel from corrosion. Titanium-clad steel under these conditions suffered comparatively intensive pitting corrosion. The use of these coatings is possible only if they can be applied to the substrate without defects. 2 references.

USSR

UDC 620.194.2:621.789:669.15'24'26

INFLUENCE OF HEAT AND MECHANICAL TREATMENT ON CORROSION CRACKING OF Kh18N10T STEEL

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 6, Nov-Dec 76 pp 690-693
manuscript received 21 Apr 75

REKHTER, D. Z., FREYD, M. KH. and KOPYLOV, G. G.

[Abstract] The purpose of this work was to determine the modes of heat and mechanical treatment of Kh18N10T steel providing the optimal combination of high mechanical properties and resistance to corrosion cracking. The tests were performed under constant load on a small 4-position installation in 35% boiling $MgCl_2$, with the potential of the specimen maintained constant at +60 mv. It is found that directed change of the fine structure of the steel, related to the creation of a polygonization substructure, can increase the corrosion cracking resistance of the steel. The optimal combination of mechanical properties and corrosion cracking resistance is produced by heat and mechanical treatment with about 30% compression and post deformation heating to 600 C for 8-25 hr. 7 references.

USSR

UDC 669.295.018.8:664

CORROSION AND ELECTROCHEMICAL BEHAVIOR OF TITANIUM ALLOYS IN MEDIA ENCOUNTERED IN THE FOOD INDUSTRY

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 6, Nov-Dec 76 pp 683-684
manuscript received 11 May 75

KRYUCHEK, V. G., and VOLYNSKIY, V. V., All-Union Scientific Research and Planning Institute for Titanium

[Abstract] A study is made of the corrosion and electrochemical behavior of the titanium alloys VT1-0, OT4 and VT5-1. It is found that the resistance of the titanium alloys depends directly on the content of sulfuric, hydrochloric and citric acids in the environment. The data produced show that media containing H_2SO_4 are most corrosive. This results from the fact that for a given pH, the rate of corrosion of titanium in sulfuric acid is higher than in hydrochloric acid. 5 references.

USSR

UDC 620.193.01+620.194.4

STUDY OF CORROSION CRACKING OF HIGH-STRENGTH STEELS IN DUTERIUM WATER

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 6, Nov-Dec 76 pp 659-662
manuscript received 23 Jun 75

ROZENFEL'D, I. L., MARICHEV, V. A. and LUNIN, V. V., Academy of Sciences
USSR, Institute of Earth Physics

[Abstract] A study is made of the kinetics of crack growth during corrosion cracking of high-strength steels types 28Kh3SNMFVA and 30KhGSNA in solutions of sodium chloride prepared with ordinary and deuterium water. It is shown that at crack growth rates exceeding the critical rate, hydrogen embrittlement in the deuterium electrolyte is approximately 7 times slower than in the ordinary water electrolyte. This difference in crack growth rates is considered to be direct proof of the leading role of hydrogen embrittlement in the mechanism of corrosion cracking at high crack growth rates. 11 references.

USSR

SALT CRACKING OF TITANIUM ALLOYS

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 6, Nov-Dec 76 pp 643-648
manuscript received 26 Jul 74

PLEKHANOVA, N. G., BORISOVA, YE. A., MODESTOVA, V. N., BARYSHEVA, T. V.
and TOMASHOV, N. D.

[Abstract] This work presents a study of the salt-cracking resistance of a number of structural alloys, the influence of preliminary hydrogenation on the stability of VT20 alloy and the distribution of hydrogen through the cross section of the specimen. It is found that at a constant temperature of 400 C and equal time to rupture of 1000 hr, the salt cracking resistance, characterized by the ratio of the rupture stress under a salt film to the rupture stress without the salt film, decreases with increasing content of aluminum in a number of alloys in the annealed state. The salt cracking resistance decreases not only with increasing temperature but also with decreasing stress and increasing time of action of salt corrosion, facilitating the formation of stress concentrators. The rupture of welded specimens of VT20 alloy without a salt film generally occurs through the base metal, whereas beneath the salt film rupture occurs through the heated zone, the crack developing primarily along grain boundaries. As layer-by-layer analysis shows, during salt cracking of VT20 specimens, even without preliminary hydrogenation, there is an increased concentration of hydrogen near the crack, which drops greatly with decreasing distance from the surface. The high concentration of hydrogen near the crack location means that the introduction of hydrogen in a concentration of up to 0.1% before stress is applied has no significant influence on the time to rupture of VT20 specimens. 21 references.

USSR

UDC 620.193.2

THE CORROSION OF REFRACTORY BORIDES IN WATER AT HIGH PARAMETERS

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 6, Nov-Dec 76 pp 742-744
manuscript received 3 Apr 75

ARABEY, B. G., GLUKHOV, V. A. and MARKOV, YU. M.

[Abstract] Europium hexaboride and other boron compounds and alloys are used as neutron-absorbing moderators in nuclear reactors. Considering that water is the primary coolant used in modern reactors, the present study is dedicated to the behavior of europium hexaboride and its combinations with refractory metal diborides in water at high pressures and temperatures. Specimens were tested in distilled water in autoclaves at 150-350 C, pressures 4.85 to 168.8 atm. The corrosion rate was determined from the change in mass and external appearance of the specimen during the tests. Europium hexaboride is found to have low corrosion resistance in water at high parameters. The corrosion resistance can be increased by alloying europium hexaboride with tantalum, chromium and hafnium diborides; although the corrosion resistance of $\text{EuB}_6\text{-MeB}_2$ composites is significantly higher than the corrosion resistance of EuB_6 , even these composites require protection from contact with water. 5 references.

Forming

USSR

UDC 621.7.044.7

MACHINE METALS BY MAGNETIC PRESSURE

Moscow MASHINOSTROITEL' in Russian No 11, Nov 76 pp 28-29

LAPSHIN, M. G., MIROSHNIKOV, V. G. and POPOV, V. YA., Candidate of Technical Sciences

[Abstract] Among a group of high-speed electrophysical machining methods is the machining of metals by the pressure of a strong pulsed magnetic field. Deformation of the metal by a pulsed magnetic field is based on the conversion of electrical energy accumulated in a capacitor, during discharge through a solenoid inductor, into the energy of the magnetic field which performs the work of deformation. The machined blank is placed in the inductor. The capability of a magnetic field to penetrate through dielectric materials permits the deformation of blanks fastened in glass and plastic vessels. When parts are produced by the method of magnetic pressure, the labor intensity of the machining is decreased, and the need for welding is eliminated. Figures 6.

USSR

UDC 621.983.044

PROCESSES OF SHEET STAMPING BY EXPLOSION WITH COMBINATION OF OPERATIONS

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 7, 1976 pp 24-26

ZORIK, V. YA.

[Abstract] The employment of processes with the combination of several operations in one die makes it possible to expand the technological possibilities of sheet stamping, increase productivity, improve quality, and decrease production costs for a wide assortment of complex-shaped parts from flat and tubular blanks. Various aspects of such processes are described. Technological processes with the combination of shaping and separating operations have been introduced at a number of enterprises. Figures 4; tables 2; references 5; all Russian.

USSR

UDC 621.73.043

A NEW METHOD OF THREE-DIMENSIONAL STAMPING

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 7, 1976 pp 41-42

TROITSKIY, A. P.

[Abstract] A new method of three-dimensional stamping consists basically in the fact that in the third stage of the stamping process, use is made of a seam previously cut off from a forging stamped in the conventional manner. This permits the stamping forging to be shaped from a blank with a smaller volume. Figures 2; references 1 Russian.

Heat Treatment

USSR

UDC 669-419.4:620.18:620.251

INFLUENCE OF HEAT AND MECHANICAL TREATMENT CONDITIONS ON THE FORMATION OF THE STRUCTURE AND PROPERTIES OF THE DISPERSION-HARDENED ALLOY VDU-2

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 11 1976 pp 47-51

LYUKEVICH, V. I. and LEVINSKAYA, M. KH., All-Union Scientific Research Institute of Aviation Materials

[Abstract] A study is made of the influence of deformation during extrusion and cold drawing with subsequent annealing on the structure and properties of the dispersion-hardened alloy VDU-2 (Ni + 3% HfO_2). The heat resistance of bars of dispersion-hardened VDU-2 is determined by the total degree of deformation of the initial powder blanks and the temperature of recrystallization annealing and is practically independent of the ratio of the degree of deformation during extrusion and cold drawing. Selection of specific thermomechanical conditions for treatment is one of the most important stages in the development of dispersion-hardened alloys and a necessary condition for the production of a high level of heat resistance. 4 references.

Instrumentation and Equipment

USSR

UDC 621.983.044.4:621.983.06

THE T1223 ELECTROHYDRAULIC PULSE PRESS

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 8, 1976 pp 25-26

STARKOV, N. V., CHERUSHEV, V. V., and SAYENKO, V. A.

[Abstract] The T1223 electrohydraulic pulse press, with a reserve energy of 20 kilojoules, is intended for the cold stamping of sheet and tubular blanks, in particular for shallow drawing, notching, hole punching, and distribution. The specifications are given. The press has been adopted by the interdepartmental committee and has been recommended for series output at the experimental plant of the Electrohydraulics Planning and Design Office of the Ukrainian SSR Academy of Sciences. Figures 3; references 2; both Russian.

USSR

A METHOD OF MAKING AN ANODE FOR DISSOCIATING ALKALI METAL AMALGAMS

Moscow TSVETNYYE METALLY in Russian No 11, Nov 76 p 97

[Abstract] A brief description of a new method that has been developed in the USSR for making a graphite anode for use in the sodium amalgam reactors of mercury cathode cells in electrolytic production of caustic soda. A mixture of carbon filler, carbon-containing binder and powdered activator is thoroughly mixed and molded on a press to shape the anode elements. The elements are then annealed and graphitized. The anodes made by this method decompose amalgams faster than conventional anodes, can be used on weaker concentrations of solution, are stronger and more stable, have higher density and reduce mercury expenditures. The invention is being patented.

USSR

UDC 669.187.2.036

SECONDARY CURRENT FEEDERS FOR LARGE ELECTRIC STEEL MELTING FURNACES

Moscow STAL' in Russian No 11, 1976 pp 1002-1004

ZINUROV, I. YU., KUZNETSOV, L. K., RABINOVICH, V. L., STEPANOV, N. A., and ZHAVORONKOV, K. P., The Chelyabinsk Metal Plan and "Tsentronegochermet"

[Abstract] The requirements for a secondary current feeder for electric furnaces include minimal active and reactive resistance, steady distribution of power in all phases, small variations of reactive resistance during

various phases or electrode positions, dependability and simplicity for servicing, and minimal electrodynamic power loss in various phases. The search for these features involved domestic and foreign products, which were tested, for a period of seven months, at the Chelyabinsk Metals Plant. Cable features and the shape of the current feeder were examined, and a triangular version was eventually found that reduced reactive resistance by 30%, thereby increasing feeder power and shortening melting time. A later version decreased reactive resistance by 1.2 times and decreased asymmetry by four times. Presently, the Chelyabinsk Plant is testing modernized current feeders with six lines, triangular construction, and flexible cables. Figures 2; tables 2; references 5: 4 Russian and 1 English.

Mechanical Properties

USSR

UDC 669.017

EFFECT OF COPPER AND MAGNESIUM ADDITIONS ON MECHANICAL PROPERTIES OF THE Zn-22%Al ALLOY

Ordzhonikidze IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, TSVETNAYA METALLURGIYA
in Russian No 5, 1976 pp 90-95 manuscript received 15 Sep 75

RODIONOV, B. V., KAYBYSHEV, O. A., KAZACHKOV, I. V., Ufa Aviation Institute

[Abstract] Specimens of the Zn-22%Al alloy containing 0.01-0.5% Mg and 0.5-3.5% Cu were melted in a graphite crucible under flux consisting of equal parts of NaCl and KCl to prevent burning out and oxidation of zinc. The obtained ingots were diffusion-annealed for 48 hours at 350°C, extruded into rods of 20 mm in diameter and then rolled into strips 0.5 mm thick. Some of the obtained specimens were heated and quenched after rolling and others were annealed at 350°C and air-cooled. The tests for mechanical properties showed that the most rational additions were 0.05% Mg or 2% Cu. Besides the study of separate effects of magnesium and copper, their combined effect on mechanical properties of the Zn-22%Al was also studied. It was found that the dependence of strength on the test temperature of the Zn-22%Al-2%Cu-0.05%Mg alloy had the same characteristics as the alloy with magnesium addition only. This shows that in combined alloying, the addition of magnesium has a greater effect on mechanical properties of the Zn-22%Al alloy than the addition of copper. Figures 3; tables 3; references 7: 2 Russian and 5 Western.

Powder Metallurgy

USSR

UDC 621.762.2

METHODS OF MAKING REFRACTORY NICKEL ALLOY POWDERS

Kiev POLUCHENIYE, SVOYSTVA I PRIMENENIYE RASPYLENNYKH METALLICHESKIKH POROSH-KOV [Production, Properties and Use of Sputtered Metal Powders, Collection of Works] in Russian, 1976 pp 134-140

MUSIYENKO, V. T., KHODKIN, V. I. and ZVEREVA, YE. A.

[From REFERATIVNYY ZHURNAL, METALLURGIYA No 11, 1976 Abstract No 11G536 by V. Kvin]

[Text] An investigation is made of the properties of nickel alloy powders produced by sputtering a melt with the use of different technological processes: I--the rotating electrode method, II--sputtering by an argon jet, III--sputtering in an electron-beam furnace on a rotating funnel. All methods produce spherical powders with size determined by sputtering conditions and controllable over given limits. Method III gives the purest powders with respect to gas impurities. Bars made by extruding blanks of powders sputtered by different methods have the same level of mechanical properties both at room temperature and at high temperatures. The most economical for practical use is the installation for sputtering with a stream of argon. The simplest and most reliable for practical use is the installation for sputtering of a rotating electrode.

USSR

UDC 621.92:669.295

INVESTIGATION OF THE ABRASIVE PROPERTIES OF QUASI-MOLTEN TITANIUM CARBIDE

Kiev POROSHKOVAYA METALLURGIYA in Russian No 11(167), Nov 76 pp 44-47 manuscript received 3 May 76

SAMSONOV, G. V., deceased, ADAMOVSKIY, A. A., POLISHCHUK, V. S. and GON-CHAROVA, N. I., Institute of Problems in the Science of Materials, Academy of Sciences UkrSSR, Donetsk Chemical Reagent Plant

[Abstract] An investigation is made of the abrasive properties of quasi-molten titanium carbide. It is found that titanium carbide with 17.4 wt.% or more of bound carbon is superior in abrasive properties to white electro-corundum, as well as titanium carbide melted in a Tamman furnace, but is inferior to titanium carbide made from the elements in a plasma and by electric-arc melting. It is shown that quasi-molten titanium carbide with 19.0 wt.% or more of bound carbon is effective for short-term processes of abrasive machining (up to 10-20 minutes); in long processes, quasi-molten titanium carbide containing from 17 to 19 wt.% of bound carbon has greater productivity. References 9 Russian.

USSR

UDC 621.762.2

PARTICULARS OF CHEMICAL REACTIONS IN IMPACT LOADING OF POWDER MIXTURES

Kiev VLIYANIYE VYSOKIKH DAVLENIY NA VESHCHESTVO [Influence of High Pressures on Matter, Collection of Works] in Russian, 1976 pp 59-62

MATYTSIN, A. I., AVVAKUMOV, YE. G., DERIBAS, A. A., D'YAKOV, V. YE. and STAVER, A. M.

[From REFERATIVNYY ZHURNAL, METALLURGIYA No 11, 1976 Abstract No 11G543 by Ya. Gendlin]

[Text] Studies are done on powder mixtures of different granulatiries and compositions: Nb + Sn (18, 25, 26, 44 and 55 at.%), SnO₂ + reducing agent (C, Si, BaI, W, Zn), Ti + B (33, 44, 52, 67 and 92 at.%). Loading of the mixtures was done in cylindrical steel storage container ampules. The yield of reaction products rises with a reduction in the standard isobaric-isothermal reaction potential ΔZ° and with an increase in the contact surface of the reacting particles, and jumps sharply when a certain impact loading rate is reached. It is pointed out that pores and regions along the boundaries of the particles play a decisive role in the reaction. It is shown that the synthesis of refractory compounds is feasible without the use of expensive vacuum heating. References 6.

USSR

UDC 621.724

INFLUENCE OF GAS ON THE PROCESS OF SINTERING POROUS ARTICLES. II. SINTERING ITEMS OF FINITE DIMENSIONS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 11(167), Nov 76 pp 22-25 manuscript received 11 Sep 75

KIPARISOV, S. S., LEVINSKIY, YU. V. and BUDANOV, S. M., Moscow Institute of Steel and Alloys

[Russian abstract provided by the source]

[Text] An examination is made of the behavior of a gas-filled pore in a solid of finite dimensions. A mechanism of pore behavior is suggested for the case where elimination of gas from the pore is limited by its diffusion to the outer surface of the specimen. Numerical solutions of the proposed differential equation are found that show how pore dimensions vary as a function of sintering time and the position of the pore in the specimen for various initial conditions. Qualitative experimental confirmation of the results is provided by a study of sintering copper cylinders molded from electrolytic powder. Reference 1 Russian.

USSR

UDC 661.665.2

HARD ALLOYS BASED ON BINARY CARBIDES WITHOUT TUNGSTEN. I. ALLOY PRODUCTION AND PARTICULARS OF STRUCTURE FORMATION DURING SINTERING

Kiev POROSHKOVAYA METALLURGIYA in Russian No 11(167), Nov 76 pp 30-34, manuscript received 4 Jan 75

SAMSONOV, G. V., deceased, VORONKIN, M. A. and BRONSHTEYN, D. KH., Institute of Problems in the Science of Materials, Academy of Sciences UkrSSR

[Russian abstract provided by the source]

[Text] An investigation is made of hard alloys in the (TiC-MeC)-NiMo system, where Me represents vanadium, niobium or tantalum. The MeC content was varied from 2 to 25 mol.% in the binary carbide. Conditions for vacuum sintering the alloys are studied; a temperature of 1320-1350°C is recommended with holding time of 0.5 hour. It is shown that the alloying carbides (MeC) have an appreciable effect on growth of the carbide grain during sintering (this effect is intensified in the series TaC → NbC → VC), which is attributed to the difference in solubility of the binary carbides in the molten alloy. References 7: 6 Russian, 1 Western.

USSR

UDC 621.762.001

FORMATION OF THE STRUCTURE OF TITANIUM CARBIDE-STEEL ALLOYS DURING SINTERING. REPORT II

Kiev POROSHKOVAYA METALLURGIYA in Russian No 10, Oct 76 pp 72-76 manuscript received 11 Jun 75

KIPARISOV, S. S., NARVA, V. K., DALYAYEVA, L. I. and CHUGUNOVA, R. S., Moscow Institute of Steels and Alloys

[Abstract] The production of high quality ferro-TiC alloys by liquid-phase sintering requires conditions such that the quantity of liquid phase is sufficient only to activate contraction, requiring conservation of open porosity. This is achieved by continuous heating to the temperature of eutectic interaction of TiC with steels at a definite rate providing for even heating of the blank, particularly near the liquid phase formation temperature, with slow subsequent heating to the optimal sintering temperature. Two types of microstructure are established in alloys sintered in the temperature interval of the eutectic unsaturated and saturated with titanium carbide: fine-grained TiC with polyhedral and fragmentary forms and coarse-grained TiC with spheroidal form. Two types of "ring structures" of titanium carbide are established: the first form develops as a result of coalescence of fine grains around grains of austenitic steel, the second -- as a result of diffusion dissolution of the alloying elements of the steel in the titanium carbide. 1 reference.

USSR

UDC 548.33

THE STRUCTURE OF HEXANITE-R

Kiev POROSHKOVAYA METALLURGIYA in Russian No 10, Oct 76 pp 47-50 manuscript received 5 Sep 75

KURDYUMOV, A. V., OLEYNIK, G. S., PILYANKEVICH, A. N., BALAN, T. R., BOCHKO, A. V., and DZHAMAROV, S. S., Institute of Material Science Problems, Academy of Sciences UkrSSR

[Abstract] Hexanite-R is a new superhard tool material consisting of compact diamond-like modifications of boron nitride. The material was recently developed at the Institute for Material Science Problems in cooperation with the Poltava Artificial Diamond and Diamond Tools Plant. The unique combination of properties of hexanite are, combining great hardness and chemical inertness to iron with impact strength superior to cubic boron nitride, makes it effective for use as a cutting tool material for the treatment of hardened steels and hard alloys, particularly parts with noncontinuous surfaces. Optical metallography is used to observe the distribution of pores and impurities, electron microfractography allows determination of the morphologic structure of the phase components. The results of these studies indicate that the conversion of wurzite BN into sphalerite BN at high pressures and temperatures, accompanied by the sintering of wurzite boron nitride powder and the formation of the structure of hexanite-R, is a recrystallization conversion involving diffusion processes. The wurzite and sphalerite components of hexanite-R differ from each other significantly both in grain size and in quality of intragrain structure. 9 references.

USSR

UDC 64-419:661.666-426:669.718:539.4

INFLUENCE OF THE INTERMEDIATE SILICON CARBIDE LAYER ON THE INTERACTION OF A CARBON FIBER WITH NICKEL

Kiev POROSHKOVAYA METALLURGIYA in Russian No 10, Oct 76 pp 44-46 manuscript received 15 Apr 75

SALIBEKOV, S. YE., ZABOLOTSKIY, A. A., KILIN, V. S., TURCHENKOV, V. A. and IGNATOVA, N. P., All-Union Scientific Research Institute for Aviation Materials

[Abstract] A study is made of the influence of an intermediate silicon carbide layer on the intensity of interaction of a carbon fiber with nickel. It is hoped that the silicon carbide layer can act as an effective diffusion barrier between the carbon fiber and nickel matrix to reduce the significant softening of the carbon fiber which is frequently noted. It is found that a thin layer of silicon carbide (about 40 Å) does act as a diffusion barrier at the carbon fiber-nickel boundary, but only up to 700-800 °C with holding times of up to 50 hr, slowing down the process of accumulation of surface defects on the fibers and thus reducing strength loss. At temperatures over 800 °C, intensive dissolution of the coating and fiber in the nickel begin, accompanied by activated recrystallization of the fiber and its catastrophic softening. Under these conditions, the silicon carbide coating is

not an effective diffusion barrier. The presence of a layer of silicon carbide on the fiber leads to an increase in the life of the fiber in oxidizing media, which may facilitate the process of formation of nickel-carbon fiber composites and increase the working temperature of the material. 8 references.

USSR

UDC 621.763

PECULIARITIES OF THE PRODUCTION AND PROPERTIES OF MATERIALS OF STAINLESS STEEL FIBERS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 10, Oct 76 pp 30-33 manuscript received 10 Sep 75

KOSTORNOV, A. G., SHEVCHUK, M. S., MAY, VL. K. and FEDORCHENKO, I. M., Institute of Material Science Problems, Academy of Sciences UkrSSR

[Abstract] In spite of their broad utilization, systematic studies of materials of stainless steel fiber and of the technology of their manufacture have never been performed. Considering that the production of a porous framework which is then used either directly or as a basis for future composite materials is a part of almost all practical applications of fibers, this work presents a study of permeable materials with a porosity of 5-70%, produced from stainless steel fibers 50 μm in diameter and 3 mm in length of steel type 1Kh18N9T. The criterion of quality of sintering of the materials was the degree of perfection of the contacts between fibers. Even with high temperature vacuum sintering, high quality of contact between particles as is characteristic for materials of nickel and nichrome fibers could not be achieved. The physical nature of austenitic steel and the presence of titanium, responsible for the quality of sintering of porous materials, do not allow the desired degree of utilization of initial fiber strength to be achieved. Only vacuum sintering produces good mechanical properties. 6 references.

Single Crystals

USSR

UDC 546.73'72:539.236

MONOCRYSTALLINE FILMS OF COBALT FERRITE

Moscow IZVESTIYA AKADEMII NAUK SSSR, NEORGANICHESKIYE MATERIALY in Russian
Vol 12, No 10, 1976 pp 1787-1790 manuscript received 24 Feb 75

SADILOV, K. A., KOMALOV, A. S., and BAURIN, V. D., Institute of Physics,
Siberian Department, USSR Academy of Sciences

[Abstract] Research is conducted on the phase composition, particularly on features of the growth, crystalline structure, and acting stresses in monocrystalline films of CO-ferrite obtained by the "sandwich method." It is established that the epitaxial growth of CO-ferrite films by the sandwich method on an MgO substrate brings about an expansion of the region of compositions corresponding to a single-phase state (CoFe₂O₄). Stresses in the films originate due to features of their growth. Figures 2; tables 1; references 11: 7 Russian, 2 Czech, and 2 Western.

Steels

USSR

UDC 621.9:669.14.018.298

STEELS OF HIGHER MACHINABILITY

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 10, 1976 pp 2-7

GOL'DSHTEYN, YA. YE. and ZASLAVSKIY, A. YA., Chelyabinsk Scientific Research Institute of Metallurgy

[Abstract] A modern and promising trend for improving the cutting machinability of steels is their alloying with lead, selenium, tellurium and calcium, i.e., by additives which form metallic and nonmetallic inclusions of a definite composition, morphology, and dispersion in the structure of the steel. These inclusions should not exert a strong influence on the mechanical and service properties of the material. To increase the cutting machinability, steel may be microalloyed by selenium (tellurium). Selenium exerts a strong influence on the composition, morphology, and degree of dispersion of the nonmetallic inclusions, especially sulfur ones. The deoxidation conditions also affect the composition and particle size of nonmetallic inclusions. The production of calcium steel, presently employed in Japan, West Germany and the USA, is currently being mastered in the USSR as well. Figures 9; tables 1; references 5; all Russian.

USSR

UDC 669.0.17;539.4.001

INFLUENCE OF HYDROGEN ON THE STRENGTH AND NATURE OF RUPTURE OF STEEL WITH VARIOUS CONCENTRATIONS OF CARBON

Kiev FIZIKO-KHIMICHESKAYA MEKHANIKA MATERIALOV in Russian Vol 12, No 5, Sep-Oct 76 pp 14-16 manuscript received 10 Jun 75

SHVED, M. M., YAREMCHENKO, N. YA. and BILYY, L. M., L'vov Institute of Physical Mechanics, Academy of Sciences UkrSSR

[Abstract] A study was made of the influence of hydrogen on the yield point and strength, as well as the nature of rupture of thin specimens, the gauge section of which was saturated clear through with hydrogen, made of materials with varying concentrations of cementite (armco iron, types 20, 45 and U8 steel). The specimens were mechanically polished and annealed in a vacuum for 1 hour. The yield point and ultimate strength increased with increasing carbon concentration. Hydrogenation of the specimens during testing caused an increase in yield point regardless of carbon concentration; the ultimate strength of armco iron increased with hydrogenation, of types 45 and U8 steel -- decreased. The metal ruptures due to the development of surfaces of separation of displacements. As armco iron is displaced during the process of hydrogenation, the hydrogen interacts with mobile dislocations, fixing them and causing them to lose their mobility, leading to an increase in the resistance to maximum plastic deformation of the metal, i.e., an increase in tensile strength. The presence of hydrogen in steel leads to a decrease in the interatomic interaction forces, therefore decreasing rupture strength. 6 references.

USSR

UDC 621.77:669.15-194.2

COLD PLASTIC DEFORMATION OF LOW-ALLOY COMPOSITE STEELS WITH FERRITE-CARBIDE STRUCTURE

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 11, 1976 pp 41-44

LIZUNOV, V. I., YEREMENKO, V. I., MAKSIMOVA, O. V. and SHKATOV, V. V., Moscow Institute of Steels and Alloys

[Abstract] A study is made of the influence of cold plastic deformation on the structure and properties of types 20, 17GS and 35GS steels with chaotic and oriented placement of carbide plates. Deformation of 10 to 75% was performed by rolling of flat specimens measuring 100 x 13 x 1.2 mm. The structural changes were studied by x-ray-structural and electron-microscope methods, and also the physical expansion of the $(110)_{\alpha}$ and $(211)_{\alpha}$ lines were determined. The structure and properties of steel with ferrite-pearlite structure depend on the location of the carbide plates in the ferrite matrix. With oriented placement of cementite plates, strength is increased by 15-20 kg/mm². The first term of the equation for additiveness considering the free ferrite has the same value, about 15% of the ultimate strength of the steel with oriented cementite plates. The strength of the composite produced before and after cold deformation is determined by the strength, size, number and orientation of carbide plates, the distance between plates, the quantity of free ferrite and the dimensions of its subgrains, as well as the fine structure of the ferrite in the pearlite. 8 references.

USSR

UDC 620.194

INFLUENCE OF BA-6 INHIBITOR ON CORROSION-FATIGUE STRENGTH OF Kh18N10 STEEL

Kiev FIZIKO-KHIMICHESKAYA MEKHANIKA MATERIALOV in Russian Vol 12, No 5, Sep-Oct 76 pp 106-107 manuscript received 11 Feb 75

IVANOV, S. S. and IVANOV, YE. S., Moscow Pedagogic Institute imeni V. I. Lenin

[Abstract] A study was made of the influence of concentration of BA-6 inhibitor and temperature on the corrosion-fatigue strength of Kh18N10T steel in a 10% solution of H_2SO_4 . The experiments were performed in a thermostat with temperature maintained to an accuracy of ± 0.5 C. The results of the study show that with increasing temperature from 20 C to 70 C, corrosion-fatigue resistance of the steel in an H_2SO_4 solution decreases from 16.5 to 2.0 kg/mm². Introduction of BA-6 helps to increase corrosion-fatigue resistance of the steel as the concentration of inhibitor is increased from 1 g/l to 5 g/l. The protective influence of the inhibitor increases to 60 C, then decreases as the temperature continues to rise. 6 references.

Superalloys

USSR

UDC 669.018.85

KhN60MKBYuT (EP879) NICKEL-BASE HEAT-RESISTANT ALLOY

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 10, 1976 pp 61-63

BUDUYEVA, V. G., BULAVINA, L. S., and RASTORGUYEVA, I. A.

[Abstract] In a description of the above-named nickel-base heat-resistant alloy, designated for work at 950-1000°C, an analysis of the tendency of the alloy toward embrittlement is conducted by calculating the density of electron vacancies. The mechanical properties of the alloy at room temperature and at the work temperature are presented, and their anisotropy is assessed. The technological plasticity of the alloy is studied, and the conditions for hot deformation are presented. Also presented is a comparative evaluation of the heat resistance. Figures 2; tables 3; references 4, all Russian.

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Thin Films

USSR

UDC 669.236+669.232]-151:669.046.42.001

ELECTRON DIFFRACTION STUDY OF THE INTERACTION BETWEEN THIN RUTHENIUM AND IRIDIUM FILMS AND ATMOSPHERIC OXYGEN

Moscow IZVESTIYA AKADEMII NAUK SSSR, METALLY in Russian No 6, Nov/Dec 76
pp 101-103 manuscript received 18 Jul 75

IGNATOV, D. V., LAZAREV, E. M. and KOROTKOV, N. A., Moscow

[Abstract] This paper is one of a series devoted to the study of oxidation of noble metals and alloys based on them. The electron diffraction method is used to determine the possible phases that arise on the surface of ruthenium and iridium specimens when free films of these metals are heated in air in the 20-900°C temperature range. After films 400-500 Å thick are heated at 100 and 200°C, the electron diffraction patterns show no oxide formation. Apparently the observed increase in the mass of bulk specimens at these temperatures is due to the adsorption of oxygen and formation of an oxide film made up of crystals smaller than 30 Å. When heated in the temperature interval of 300-900°C, ruthenium and iridium films oxidize, and the oxide films are made up of RuO₂ and IrO₂ crystals with a tetragonal lattice. Electron diffraction analysis shows that the films do not contain other oxide phases. At 800°C and higher, 400-500 Å ruthenium and iridium films completely oxidize and vaporize. References 13: 6 Russian, 7 Western.

USSR

UDC [546(682+22)]:539.238;541.18.048

THE STRUCTURE OF THIN In₂S₃ FILMS

Moscow IZVESTIYA AKADEMII NAUK SSSR, NEORGANICHESKIYE MATERIALY in Russian
Vol 12, No 10, 1976 pp 1760-1762 manuscript received 13 Jan 75

KITAYEV, G. A., DVOYNIN, V. I., UST'YANTSEVA, A. V., BELYAYEVA, M. N.,
and SKORNYAKOV, L. G., Ural Polytechnical Institute

[Abstract] Thin In₂S₃ films (1500-4000 Å), obtained by the method of chemical precipitation on an isotropic glass substrate, are amorphous independently of their thickness. They possess properties which differ from the properties of crystalline In₂S₃. Recrystallization and the appearance, connected therewith, of optical properties characterizing In₂S₃ in the films, is attained by their heating in a vacuum at 500°C. Figures 4; references 7:
5 Russian and 2 Western.

Titanium

USSR

UDC 669.295:539.432

INVESTIGATION OF THE CYCLIC STRENGTH OF TYPE VT6 TITANIUM ALLOY WITH PROGRAMMED LOADING

Kiev PROBLEMY PROCHNOSTI in Russian No 11(88), Nov 76 pp 35-39 manuscript received 3 Feb 75

VASSERMAN, N. N., GLADKOVSKIY, V. A., LUK'YANOV, O. P., KOZLOV, I. V. and ZGOGURIN, V. V., Perm' Polytechnical Institute, Perm', Leningrad

[Abstract] The paper gives the results of research on fracture of specimens of VT6 experimental titanium alloy under steady and programmed loading. The specimens were 10 mm in diameter and were tested on a fatigue machine by cantilever bending with rotation. The loading rate was 2000 bends per minute. A special programmed loading device was used for varying stress amplitudes between two levels over a wide range. It was found that the alloy has high cyclic strength characteristics under steady loads. The distribution of logarithms of durability can be approximated by a normal law only on high stress levels, whereas the distribution of restricted fatigue limits is satisfactorily described by a normal law over a wide range of durabilities. It is found that stresses above and below the fatigue limit take an active part in the process of fatigue fracture starting at 20 kgf/mm². An increase in the relative duration of action of the low stress reduces durability on the high level. This effect is due both to the damaging action of the high stress and the interaction of the stress levels as they are interchanged. References 4 Russian.

USSR

UDC 669.295.37

PRODUCTION OF TITANIUM ALLOYS WITH UNIFORM DISTRIBUTION OF REFRactory METALS

Moscow IZVESTIYA AKADEMII NAUK SSSR, METALLY in Russian No 6, Nov/Dec 76 pp 21-26 manuscript received 26 Dec 74

REZNICHENKO, V. A., GONCHARENKO, T. V., KHALIMOV, F. B. and VOYTEKHNOVA, YE. A., Moscow

[Abstract] An investigation is made of the process of formation of titanium sponge alloyed with niobium or tantalum when chlorides of titanium, niobium and tantalum are subjected to combined Kroll reduction. Phase identification was established by methods of metallographic, x-ray phase and x-ray spectral analysis. The scanning electron microscope was used to study the morphological particulars of the alloyed sponge. It is found that the components are uniformly distributed in alloys of titanium with niobium and tantalum after a single remelting of alloyed sponge produced by the Kroll process. Solid solutions based on titanium with an alloying element are formed on the chloride reduction stage. On the stage of vacuum separation of the reaction mass, mutual dissolution of primary phases takes place with the formation of solid solutions of alloyed titanium sponge that are close to

the predetermined composition of the alloy. The specifics of the process of formation of titanium sponge doped with niobium and tantalum coincide completely with the pattern of formation of Ti-Mo and Ti-W sponge, and it may therefore be assumed that these particulars will be common to other cases of Kroll reduction of titanium chlorides and refractory metals.

References 2 Russian.

USSR

UDC 669.295'25:669.046.42.001

OXIDATION OF BINARY ALLOYS OF THE TITANIUM-COBALT SYSTEM IN AIR

Moscow IZVESTIYA AKADEMII NAUK SSSR, METALLY in Russian No 6, Nov/Dec 76
p 221

VOYTOVICH, R. F., GOLOVKO, E. I. and D'YAKONOVA, L. V., Kiev

[Abstract of deposited article No 2118-76 Dep.]

[Text] An investigation is made of high-temperature oxidation of Ti-Co alloys in air at temperatures of 600, 800, 1000 and 1200°C. Methods of kinetic, metallographic, x-ray spectral and layer-by-layer x-ray phase analysis are used to show how the amount of oxidation of the alloys depends simultaneously on composition, time and temperature as determined by the influence of cobalt on oxygen solubility in the alloy and on scale formation. The authors study the phase composition and morphological peculiarities of scale formation, scale-alloy interfaces, and the particulars of redistribution of the dopant in the surface layers of the alloys during the oxidation process. Alloys of titanium with cobalt oxidize to a greater extent than titanium at 800 and 1200°C throughout the entire investigated concentration range (0-100% Co), while the alloys oxidize more than titanium at 1000°C for concentrations up to 5% Co. Titanium improves the scaling resistance of cobalt in the temperature range of 800-1200°C. References 5.

USSR

UDC 669.295.620.017

STUDY OF ISOTHERMAL TRANSFORMATIONS IN THE Ti10V and Ti10V3Al ALLOYS

Ordzhonikidze IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, TSVETNAYA METALLURGIYA in Russian No 5, 1976 pp 115-119, manuscript received 14 Jul 75

LOKSHIN, F. L., LYASOTSKAYA, V. S., KOKNAYEV, R. G., and KRASNOYARTSEVA, L. S., Moscow Aviation Technological Institute

[Abstract] Specimens of the Ti10V and Ti10V3Al alloys were heated to 900°C, kept at that temperature for an hour and then transferred to a bath where

they were kept from 30 seconds to 10 hours. The temperature of the bath was varied from 350° to 600°C. Then the specimens were cooled in water. The heat-treated specimens were subjected to metallographic and X-ray analyses. On the basis of obtained results the diagrams of isothermal transformation of the Ti10V and Ti10V3Al alloys were plotted. It was found that aluminum accelerates the decomposition of α'' martensite and retards the decomposition of the beta-phase during the isothermal treatment of these alloys. It has been also established that the isothermal treatment of these alloys at 450°C for three hours brings about better mechanical properties than heating, quenching and aging. Figures 3; references 8: 6 Russian and 2 Western.

USSR

UDC 669.295+66.094.123

KINETIC CHARACTERISTICS OF ALUMINUM CEMENTATION OF METALLIC TITANIUM IN SODIUM CHLORIDE MEDIUM

Ordzhonikidze IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIYE, TSVETNAYA METALLURGIYA in Russian No 5, 1976 pp 31-35, manuscript received 20 Nov 75

IVANOV, I. I., SANDLER, R. A., ALEKSANDROVSKIY, S. V., Leningrad Mining Institute

[Abstract] A study was made of aluminum cementation on titanium. $AlCl_3$ alloy with NaCl was placed at the bottom of a quartz ampoule and covered with a perforated quartz lid on top of which specimens of sheet titanium were placed. The air was evacuated from the ampoules and they were sealed. The ampoules were then placed in a furnace and heated for 5-60 minutes at 800-860°C. It was found that during the cementation process, in addition to Ti^{2+} and Ti^{3+} , there appeared a dispersed metallic phase which in most cases contained over 50 mass % aluminum. When the temperature was increased from 770°C to 860°C, the amount of dispersed metallic phase doubled. At a constant temperature, the amount of dispersed phase increased with increased initial concentration of aluminum. Also, the content of trivalent titanium increased. For an effective process of aluminum cementation on titanium, the trivalent titanium which forms should be reduced to bivalent titanium. To achieve this it is necessary to have an excessive amount of metallic titanium, the surface of which is not shielded by the precipitated cementate. Since increased temperature leads to the interaction between titanium and aluminum, lower temperatures assure better purification of an alloy containing small amount of aluminum chloride. Figures 3; tables 3; references 5, all Russian.

USSR

UDC 669.295:621.791.052:620.17

PROPERTIES OF THE TITANIUM ALLOY AT6 AND ITS WELDED JOINTS

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 11, 1976 pp 58-60

BLASHCHUK, V. YE., GUREVICH, S. M., VOYEVA, G. YE., Institute of Electric Welding imeni Ye. O. Paton, Academy of Sciences UkrSSR

[Abstract] A study is made of the mechanical properties and corrosion resistance of AT6 titanium alloy and its welded joints. AT6 is a high-strength titanium alloy with the composition Ti-Al-Cr-Fe-Si. Its composition on the state diagram corresponds to the area near the boundary of solubility of the alloying elements in the alpha-solid solution, which assures high thermal stability of the alloy. The studies were performed on specimens 3 and 6 mm thick, cut from forgings. The alloy and its welded joints have high ductility and strength at temperatures from -60 C to +500 C. The deformation capacity of the metal of the seam is approximately the same as of the base metal. The corrosion resistance of AT6 alloy and its welded joints in solutions of sulfuric, hydrochloric and oxalic acids at concentrations of over 3% is lower than that of alloy AT3. The alloy and its joints are corrosion resistant in solutions of acetic, formic, lactic and citric acids. 6 references.

USSR

UDC 669.71:548.6

THE INFLUENCE OF PLASTIC DEFORMATION, RECOVERY, AND RECRYSTALLIZATION UPON THE ANISOTROPY OF YOUNG'S MODULUS AND THE TEXTURE OF SHEET TITANIUM

Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 42, No 3, Sep 76 pp 664-668 manuscript received 29 Jan 76

BRYUKHANOV, A. A. and MOROZ, I. A., K. D. Ushinskiy Odessa Pedagogical Institute

[Abstract] The modulegram method is applied to an investigation of the influence of plastic deformation, recovery, and recrystallization upon the anisotropy of Young's modulus and the texture of sheet titanium. Figures 4; tables 1; references 13: 11 Russian and 2 Western.

Welding

USSR

UDC 669.295:669.017.3:621.785.3

GRAIN ORIENTATION OF WELDS OF INDUSTRIAL TITANIUM ALLOYS

Moscow IZVESTIYA AKADEMII NAUK SSSR, METALLY in Russian No 6, Nov/Dec 76
pp 122-128 manuscript received 7 Oct 75

AGEYEV, N. V., BABAREKO, A. A., BETSOFEN, S. YA., RUBINA, YE. B., MOROZOV, B. S., IL'IN, A. A. and BUNIN, L. A., Moscow

[Abstract] An investigation is made of the influence of welding on the grain orientation of the α -phase in sheets of industrial VT-1-0, VT-5-1, OT-4 and VT-14 alloys. The annealing stability of the grain orientation of the welds is studied. It is found that welding of sheets with basis or displaced basis grain orientation of α -phase deformation leads to radical changes in the grain orientation in the vicinity of the weld, which is one of the reasons for nonuniformity of the mechanical properties of welds. Welding of sheets of $(\alpha+\beta)$ -alloy VT-14 with initial grain orientation of the phase transformation $\beta(111) \rightarrow \alpha(11\bar{2}4)+(11\bar{2}0)$ has little effect on grain orientation, merely dispersing it somewhat. When items welded from α -alloys are annealed, they retain the single-component grain orientation of the base; in multicomponent grain orientations of welds, new orientations are produced in regions of scatter of the initial orientation. The presence of an appreciable quantity of a second dispersed phase enhances stability during annealing of the initial multicomponent grain orientation of alloys. An examination is made of the mechanism of formation of α -phase grain orientation in welds of the investigated titanium alloys. References 10:

4 Russian, 6 Western.

USSR

UDC 620.81:620.17:621.791.052:669.14.018.252

STRUCTURE AND PROPERTIES OF WELDED TOOL BLANKS OF NEW HIGH-SPEED STEELS

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 11, 1976 pp 22-26

DOBROVIDOV, A. N., YEVTYUSHKIN, YU. A., YEGOROV, V. I., KORIKOV, A. M. and CHERKASSKIY, A. I., Tomsk Polytechnical Institute; Tomsk Institute for Automated Management Systems and Electronics; Tomsk Cutting Tool Plant

[Abstract] A study is made of modes of friction welding of new high-speed steels with type 45 steel based on the method of planning of experiments and the regularities of change in the structure and properties of the welded joints. Over a broad area of values of the factors involved (pressure during heating and forming, time of heating and forming, relative rotation speeds), the torsional strength of welded joints of type 45 steel with high-speed steels types R12, R9K5, R6M5K5, R8M3K6S and R9M4K8F is constant with a confidence probability of 0.95 and is satisfactory. Consequently, within this broad area the friction welding modes should be selected according to technical and economic considerations rather than strength considerations. 16 references.

Miscellaneous

USSR

UDC 539.4:537.532.2

THE WAY THAT ELECTRON EMISSION IS RELATED TO CREEP OF METALLIC MATERIALS

Kiev PROBLEMY PROCHNOSTI in Russian No 11(88), Nov 76 pp 45-49 manuscript received 25 Jun 75

KLYPIN, A. A. and SOLOV'YEV, YE. S., Moscow "Order of Lenin" Aviation Institute imeni Sergo Ordzhonikidze

[Abstract] A report on a study of creep of polycrystalline metallic materials under high temperature conditions as surface electron emission varies. A qualitative relation is found between creep and the surface electron yield for different kinds of electron emission. The observed effects are interpreted on the basis of concepts of disruption of equilibrium between structural components as electron emission from the surface varies. A technique is proposed for studying the influence that surface electron emission has on creep. The essence of the procedure is that a mass separated from the test specimen, but connected to it by metal wire is subjected to different kinds of external action. References 22: 17 Russian, 5 Western.

USSR

UDC 669.3.053.2

VISCOSITY, DENSITY AND SURFACE TENSION OF SULFIDE MELTS OF COPPER, IRON AND MATTES

Moscow VAZKOST', PLOTNOST' I POVERKHNOSTNOYE NATYAZHENIYE SUL'FIDNYKH RAS-PLAVOV MEDI, ZHELEZA I SHTEYNOV in Russian, 1976 (manuscript deposited in VINITI 28 Jul 76, No 2929-76 Dep.), 12 pp

BLAGOVESHCHENSKIY, YU. V., BRYUKVIN, V. A., ZHEGLOV, V. N., FINIKOV, V. G. and TSYBIN, O. I., Institute of Metallurgy, Academy of Sciences USSR

[From REFERATIVNYY ZHURNAL, METALLURGIYA No 11, 1976 Abstract No 11G325DEP by the authors]

[Text] The density, viscosity and surface tension are determined for copper mattes of the following compositions (in %): Cu 10.7, Fe 49.5, S 25.5 and Cu 61.1, Fe 10.0, S 19.8. The viscosity of the lean (high-iron) matte drops from 0.055 cSt at 970°C to 0.03 cSt at 995°C. The viscosity of the rich (high-copper) matte is 10-15% lower than that of a Cu₂S melt in the temperature range of 1150-1250°C, being 0.87 cSt at 1150°C. The melting point of the lean matte is 950-960°C, and that of the rich matte is 1100°C. The density of the lean matte in the molten state approaches that of slag melts, and the surface tension is lower than in FeS and Cu₂S melts, remaining constant over a range of 1100-1300°C. Figures 3, table 1, references 20.

USSR

UDC 669.71'295

CONCERNING THE TITANIUM-RICH SECTION OF THE Ti-Al PHASE DIAGRAM

Moscow IZVESTIYA AKADEMII NAUK SSSR, METALLY in Russian No 6, Nov/Dec 76
pp 192-198 manuscript received 24 Oct 74

KORNILOV, I. I., deceased, NARTOVA, T. T. and CHERNYSHOVA, S. P., Moscow

[Abstract] Methods of physicochemical analysis were used in studying the titanium-rich region of alloys of the Ti-Al system containing from 0 to 33.4 at.% (22 wt.%) of aluminum. The research was done by the methods of differential thermal, microstructural, x-ray and microscopic x-ray spectral analysis, and also by determination of the resistivity, hardness and corrosion properties of the alloys. It was found that solid-phase reactions in this series of alloys take place at temperatures from 882 to 1190-1210°C. The peritectoid reaction $\alpha \rightarrow \beta + \alpha_2$ occurs at 1080°C. The compound Ti_3Al is formed in the reaction $\beta \rightarrow Ti_3Al$ at a temperature of 1125°C. The following phase regions occur in the investigated part of the system in the temperature range of 500-800°C: α , $\alpha + \alpha_2$ and α_2 . The phase boundary $\alpha/(\alpha + \alpha_2)$ lies at 11.8-13.4 at.% (7-8 wt.%) Al, and $(\alpha + \alpha_2)/\alpha_2$ -- at 22.4 at.% (14 wt.%) Al in the given temperature range. References 14: 3 Russian, 11 Western.

USSR

UDC 669.721'859

INVESTIGATION OF THE SOLUBILITY OF SAMARIUM IN A MAGNESIUM-BASE SOLID SOLUTION

Moscow IZVESTIYA AKADEMII NAUK SSSR, METALLY in Russian No 6, Nov/Dec 76
pp 204-208 manuscript received 1 Dec 75

ROKHLIN, L. L., PADEZHNOVA, YE. M. and GUZEY, L. S., Moscow

[Abstract] The paper gives the results of research on the solubility of 99.8% pure samarium in 99.95% pure magnesium (MG95). The alloys were melted under VI2 flux containing 38-46% $MgCl_2$, 32-40% KCl , 3-5% CaF_2 , 5-8% $BaCl_2$, 1.5% MgO and no more than 8% $NaCl + CaCl_2$. The samarium was added in the form of a ligature of $Mg + 30\% Sm$. The ingots were pressed under heat and cut into specimens which were then annealed at different temperatures. Solubility was determined by the method of electrical resistance and by microscopic analysis. It is found that the Mg-Sm phase diagram on the magnesium side is of the eutectic type with eutectic conversion temperature of 542°C. Samarium has limited solubility in solid magnesium, decreasing with lower temperatures. The maximum solubility of samarium in magnesium (at the eutectic conversion point) is 5.8 wt.% (0.99 at.%). At 200°C, the solubility of samarium in magnesium is 0.4 wt.% (0.063 at.%). A comparative study of phase diagrams of magnesium alloys with the first four lanthanides shows increasing solubility in solid magnesium with an increase in the atomic number of the rare earth metal, and a corresponding reduction in the eutectic conversion point. Samarium fits into this pattern. References 9 Russian.

USSR

UDC 669.295-24:539.370

TWO EFFECTS OF REVERSIBLE SHAPE CHANGE IN TITANIUM NICKELIDE

Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 42, No 3,
Sep 76 pp 658-661 manuscript received 26 Nov 75

KHACHIN, V. N., GYUNTER, V. E., and CHERNOV, D. B., the V. D. Kuznetsov
Siberian Physicotechnical Institute; the Scientific Research Institute of
Standardization and Consolidation, Moscow

[Abstract] A study is made of the influence of the temperature of preliminary
plastic deformation of titanium nickelide, and the influence of the arising
internal stresses upon direct and inverse martensite conversion. It is found
that depending upon the conditions, plastic deformation in titanium nickelide
creates two different types of effect sources on the basis of two different
types of the anisotropic dislocation structure. Figures 4; references 15:
6 Russian, and 9 Western.

USSR

UDC 678.067.5:534

CHANGE OF PROPAGATION VELOCITY AND ATTENUATION RATE OF ULTRASOUND IN CARBON
FIBERS IN RELATION TO THE PROCESSING TEMPERATURE

Riga MEKHANIKA POLIMEROV in Russian No 4, 1976 pp 738-739 manuscript
received 29 Sep 75

KOTOSONOVA, V. YA., GORBACHEVA, V. O., VARSHAVSKIY, V. YA., and AZAROVA,
M. T., All-Union Scientific Research Institute of Artificial Fibers, Mytishchi

[Abstract] In an experimental investigation of the change of propagation
velocity and attenuation rate of ultrasound in carbonic fibers in relation
to the processing temperature, it is established that for carbon fibers
of polyacrylonitrile, processed at temperatures above 2400°C, there is
observed a simultaneous increase in the velocity and the attenuation rate of
ultrasound, which is uncharacteristic for continuous solid media. For
carbon fibers of viscose cord, the velocity and the attenuation factor of
ultrasound change in the same manner as for a continuous solid. Figures 1;
references 7: 3 Russian and 4 Western.

USSR

UDC 546.26:661.66.25

STAGES IN THE GRAPHITIZATION PROCESS OF CARBON MATERIALS

Moscow IZVESTIYA AKADEMII NAUK SSSR, NEORGANICHESKIYE MATERIALY in Russian
Vol 12, No 10, 1976 pp 1791-1795 manuscript received 25 Feb 75

VIRGIL'YEV, YU. S. and PEKAL'N, T. K.

[Abstract] Carbon materials are graphitized in two stages: first the displaced atoms pass into an equilibrium position which is accompanied by some straightening of the packets of crystallographic planes, which ends at the temperature when the packets abut ribwise against each other; in the second stage a decrease in the distortion of the planes (i.e., an increase of the texturization) permits thickening of the packets in a direction perpendicular to the base plane, via diffusion of the vacancies. Figures 4; tables 2; references 19: 12 Russian and 7 Western.

USSR

UDC 546.261(821.831):541.66

LOW-TEMPERATURE CALORIMETRIC STUDY OF IRRADIATED Ti AND Zr CARBIDES

Moscow IZVESTIYA AKADEMII NAUK SSSR, NEORGANICHESKIYE MATERIALY in Russian
Vol 12, No 10, 1976 pp 1800-1803 manuscript received 3 Feb 75

TOPCHYAN, L. S., OGORODNIKOV, V. V., BENINA, L. A., and MURZIN, L. M.,
Institute of Physics, Georgian SSR Academy of Sciences

[Abstract] Reactor irradiation of TiC and ZrC at low temperatures (120°K) by small integral doses ($D=2.5 \cdot 10^{17}$ neutr/ cm^2) brings about a considerable accumulation of radiation defects. A temperature region of $160-130^{\circ}\text{K}$ has been disclosed, in which a heat release of 95.9 ± 12 and 84.6 ± 15.5 cal/mole is observed, respectively for TiC and ZrC, caused by annealing of the accumulated radiation defects; this heat release is tied to the annihilation of weakly dissociated Frenkel pairs and the liberation of interstitial atoms from impurity traps. Figures 1; tables 3; references 15: 9 Russian and 6 Western.

USSR

UDC 546.26:541.121;539.24

THE RELATIONSHIP BETWEEN THE THERMODYNAMIC PROPERTIES AND THE STRUCTURE OF CARBON MATERIALS

Moscow IZVESTIYA AKADEMII NAUK SSSR, NEORGANICHESKIYE MATERIALY in Russian, Vol 12, No 10, 1976 pp 1872-1874 manuscript received 24 Jan 75

FEDOROV, V. B., KHAKIMOVA, D. K., AVDEYENKO, M. A., BUCHEROV, L. M., and SHIPKOV, N. N.

[Abstract] The interrelationship of the thermodynamic properties of carbon materials with their structure is sought in relation to the presence of metastable equilibria in such materials. On the basis of the Born model, a thermodynamic model of carbon materials is constructed, in which surface effects are taken into account. Representation of the thermodynamic characteristics of carbon materials in this model permits the description of "frozen" thermodynamic functions above the annealing temperature, and makes it possible to understand their behavior in relation to the temperature. Figures 2; tables 1; references 11: 8 Russian and 3 Western.

USSR

UDC 669.419.4:539.374.6

FORMATION OF JOINTS BETWEEN METALS WITH SIMULTANEOUS PLASTIC DEFORMATION

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 11, 1976 pp 45-47

YERSHOV, A. A., SYCHEVA, T. A. and ZASUKHA, P. F., Urals Scientific Research Institute for Ferrous Metals

[Abstract] A study is made of the deformation structure and nature of changes in the relief of contact surfaces of dissimilar metals upon simultaneous deformation of multilayer metal structures, ranging from slight compression to seizing, as well as the influence of plastic deformation of contact surfaces on the formation of sectors of seizing. The studies were performed on models of 3-layer bimetallics and samples of commercial bimetal. The quality of bonding between bimetallics produced by the method of cold cladding, it is discovered, is determined by the degree of plastic deformation of the contact layers, which is necessary in order to rupture brittle oxide and other films, produce juvenile surfaces with active centers and bring the surfaces together. 6 references.

USSR

UDC 669.788:539.4

FORMS OF MANIFESTATION OF HYDROGEN EMBRITTLEMENT IN METALS AND ALLOYS

Kiev FIZIKO-KHIMICHESKAYA MEKHANIKA MATERIALOV in Russian Vol 12, No 5, Sep-Oct 76 pp 3-10 manuscript received 7 Jul 75

KOLACHEV, B. A. and GABIDULLIN, R. M., Moscow Institute of Aviation Technology

[Abstract] A discussion is made of various methods of classification of hydrogen embrittlement of metals. A classification is suggested based on sources causing the hydrogen embrittlement. The basic regularities of development of each type of brittleness are analyzed. The approach taken toward classification of embrittlement allows the type of brittleness to be related to the conditions under which it develops. Type I results from sources present in the initial metal due to elevated hydrogen content before application of stress; type II results from sources which develop in the metal with elevated hydrogen content in the process of plastic deformation. Eight different types of brittleness caused by these two sources of hydrogen are distinguished and described. 32 references.

USSR

STUDY OF THE PROCESS OF LINEAR CONTOURED BEAM LASER HARDENING OF MATERIALS

Kishinev ELEKTRONNAYA OBRABOTKA MATERIALOV in Russian No 5(71), 1976 pp 22-25

KOVALENKO, V. S., CHERNENKO, V. S. and GOLOVKO, L. F., Kiev

[Abstract] Previous studies have shown that exposure to moderate laser radiation can increase the strength of a number of types of steel. In the development of the technology for strengthening of steels by this method, it is necessary to determine the range of optimal overlap factors, as well as the influence of the energy characteristics of the laser radiation on the process of formation of the hardened layer. Studies were performed using an experimental laser developed at the Laser Technology Laboratory of Kiev Polytechnical Institute in the following modes: pulse radiated energy $E = 10 \text{ J}$; pulse length $\tau = 4 \cdot 10^{-3} \text{ s}$; focal length of optical system $f = 50 \text{ mm}$; degree of defocussing of radiation $\Delta f = -3 \text{ mm}$. If the microhardness of the material is taken as the criterion of hardening, beginning at a spacing of 0.2 D the dimensions of the tempered portion of the zone are stabilized for all overlap factors at the $\lambda = 100 \mu\text{m}$ level and the dimensions of the hardened area increase linearly with increasing overlap factor. As the power density of radiation increases, both the width of the zone of linear hardening and its depth increase. Effective performance of the process thus requires high energy densities, though not exceeding the threshold densities for the materials in question.

USSR

EROSION OF TRANSITION METALS IN GROUPS IV-VI AND VIII UNDER THE INFLUENCE OF POWERFUL LASER RADIATION

Kishinev ELEKTRONNAYA OBRABOTKA MATERIALOV in Russian No 5(71), 1976 pp 5-7

SAMSONOV, G. V., VERKHOTUROV, A. D., ROSHCHINA, A. I., VASIL'YEV, A. V. and KLIMENKO, V. P.. Kiev

[Abstract] A study is made of the behavior of metals groups IV-VI and VIII under intensive laser radiation. A type GOS-30m laser radiating at $1.06 \mu\text{m}$ with a pulse length of 1 ms was focussed onto the surface of the metal studied by a lens with a focal length of 250 mm. The diameter of the focal spot was maintained at about 0.8 mm producing an energy density of $6 \cdot 10^7 \text{ w/cm}^2$ at the surface of the specimen. Metals studied were Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Fe, Co, Ni and Cu, all polished to a surface smoothness of grade 9 according to the Soviet Smoothness Standard. The metals fell in the following sequence of increasing erosion resistance: Ti-Zr-Co-Ni-Fe-Hf-V-Nb-Mo-Cr-Ta-W-Cu, different from the sequence produced at lower levels of radiated power. The experiment showed that as the laser power is increased from 10^6 to $6 \cdot 10^7 \text{ w/cm}^2$, the erosion increases by more than an order of magnitude, primarily due to an increase in the diameter of the holes produced. 14 references.

USSR

UDC 669.187.25

MELTING IRON-NICKEL AND IRON-NICKEL-COBALT ALLOYS IN LARGE CAPACITY INDUCTION FURNACES

Moscow STAL' in Russian No 11, 1976 pp 1004-1007

IVANOV-FILIPOV, F. V., PUTIMTSEV, B. N., KOROL', L. N., and VERBITSKIY, K. P., Central Scientific Research Institute for Ferrous Metallurgy, and the "Dneproproststal'" Plant

[Abstract] The tests were conducted in a furnace of 7-ton capacity, using diffusion reduction of a metallic smelt with slag of calcium borate, powdered aluminum or ferrosilicon, followed by deoxidation with new slag, and finally, precipitate reduction with silicon, manganese, calcium-silicon and nickel-magnesium compounds. The initial tests used pure charging materials, but after low temperatures and insufficient reaction of the slag, a preliminary step was added using aluminum chunks for a precipitate reduction before the addition of other compounds. An aeration process was used to reduce oxygen content. The addition of aluminum chunks led to a reduction in iron oxide to 0.75%. The high (0.2%) aluminum content of the alloy may be undesirable for some uses, and in later variants an iron with low oxygen content was used.

Significant reduction of non-metallic substances, including oxygen, was achieved by the aeration process using argon. The positive results obtained with this type of alloy made it possible to develop a dependable technology for other precision alloys using this type of furnace. Figures 1; tables 4; references 4, all Russian.

USSR

UDC 546.65:541.44 + 541.12.034.2

THE RESILIENCE OF RARE EARTH METAL HYDRIDES UNDER HIGH PRESSURE

Moscow NEORGANICHESKIYE MATERIALY in Russian No 11, 1976 pp 2088-2089
manuscript received 4 Apr 75

KASHKIN, I. O., BELASH, I. T., PONYATOVSKIY, YE. G., KOST, M. YE., and MIKHEYEVA, V. I., The Institutes for Solid State Physics, Academy of Sciences of the USSR

[Abstract] An ultrasonic method is described for measuring pulverized-form hydrides under pressure in a steel cylindrical chamber of 16 mm in diameter. Ultrasonic measurements were taken by a phase comparison method in an operating frequency range of 9.5--11.5 mgh. The measurements were then used to calculate the speed of longitudinal and transverse waves, and finally, to calculate resilience modules for the specimens tested in relation to varying pressure. Three different hydrides were processed. Results indicated that the hydrides had 2-3 times higher resilience than the pure metals, indicating rapid increase in durability through the hydridization process. This has also been observed in carbides and nitrides of these rare earth metals. No electronic transfer was registered in Ce hydrides at the pressures tested, and other factors indicated that Ce hydrides would have similar properties to the pure cerium. Figures 1; references 6: 4 Russian and 2 English.

USSR

UDC 621.9.047.7

INFLUENCE THAT THE CONCENTRATION OF HARDENING γ' -PHASE IN REFRACTORY CHROMIUM-NICKEL ALLOYS HAS ON THE RATE OF THEIR ELECTROCHEMICAL TREATMENT IN NITRATE AND CHLORATE SOLUTIONS

Kishinev ELEKTRONNAYA OBRABOTKA MATERIALOV in Russian No 4(70), 1976 pp 14-17

PETRENKO, V. I., DIKUSAR, A. I. and ARZHINTAR', O. A., Kishinev

[Russian abstract provided by the source]

[Text] It is shown that the rate of electrochemical treatment of refractory chromium-nickel alloys in chlorate and nitrate solutions depends on the

content of hardening γ' -phase -- intermetallic compound $\text{Ni}_3(\text{Al, Ti})$. Anomalously high rates of dissolution are associated with disintegration of γ' -phase. In the case of dissolution in sodium chlorate (rotating disk electrode, $1-15 \text{ A/cm}^2$) total disintegration of the γ' -phase was observed, whereas the γ' -phase underwent partial electrochemical dissolution in nitrates. The rate of electrochemical treatment of chromium-nickel alloys with a high content of γ' -phase in nitrate and chlorate solutions is higher than in sodium chloride solutions. References 7: 6 Russian, 1 Western.

USSR

UDC 539.4

INVESTIGATION OF THE STRENGTH CHARACTERISTICS OF POROUS MATERIAL BASED ON CONTINUOUS NICHROME FIBERS

Kiev PROBLEMY PROCHNOSTI in Russian No 11(88), Nov 76 pp 61-62 manuscript received 25 Sep 75

KARPINOS, D. M., RUTKOVSKIY, A. YE., VELICHKO, V. I. and PUZHANSKIY, G. A., Institute of Problems in the Science of Materials, Academy of Sciences UkrSSR, Kiev

[Russian abstract provided by the source]

[Text] A study is done on the way that the strength characteristics of porous material based on continuous nichrome fibers depend on porosity and sintering temperature. Comparative results are given from mechanical tests of nichrome powders, compacts and fibers. It is found that a material can be made on the basis of nichrome fiber that has higher mechanical characteristics than the powder material with the same porosity. References 6: 5 Russian, 1 Western.

USSR

UDC 669.2/.8

CONDITIONS FOR PRODUCTION OF THE Li-Pb SYSTEM ALLOYS

Ordzhonikidze IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, TSVETNAYA METALLURGIYA in Russian No 5, 1976 pp 155-156 manuscript received 26 Jul 75

KIPARISOV, S. S., PEDOS, S. I., FISTUL'A, A. D., GERARDI, H. M., Moscow Institute of Steel and Alloys

[Abstract] Several specimens of the Li-Pb and Li_1Pb_2 alloys were melted in evacuated quartz ampoules. The initial components (Li and Pb) were placed

in containers made of alundum, iron, or Mo, Ta and Nb foils. The best results were obtained with a niobium container where the obtained ingot did not fuse with the walls of the container. The alloys were melted at various temperature regimes. The best results were obtained for LiPb alloy when the alloy was heated to 600°C and kept at that temperature for an hour, and for Li_1Pb_2 when it was heated to 800°C and kept at that temperature for 20 minutes. To eliminate the chemical heterogeneity, the specimens were annealed in vacuum at 310°C and then quenched in water. Figure 1; references 5: 4 Russian, 1 Western.

USSR

UDC 669.725.25.74;295:584.5

UNBALANCED CRYSTALLIZATION OF EUTECTIC ALLOYS OF TRANSITION ELEMENTS WITH BERYLLIUM

Ordzhonikidze IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, TSVETNAYA METALLURGIYA in Russian No 5, 1976 pp 158-159 manuscript received 31 Oct 75

VARICH, N. I., PETRUNINA, A. N., Dnepropetrovsk State University.
Chair of the Physics of Metals

[Abstract] The purpose of this study was to establish certain laws governing the formation of eutectic composition alloys of transition elements with beryllium under rapid cooling rates. Alloys of eutectic or near-eutectic composition such as Cr-Be, Mn-Be, and Ti-Be were investigated. The specimens for the study were obtained by crystallization at a cooling rate of 10⁷ degrees per second. The obtained specimens were subjected to X-ray analysis. It has been found that crystallization of transition element-beryllium proceeds along the metastable diagram. An interstitial metastable phase, with a hexagonal lattice of C/a ratio=0.88-0.91, was found in the eutectic and near-eutectic alloys of the transition element-beryllium systems. During annealing, the metastable hexagonal phase decomposes and α -solid solution and equilibrium phase of Be-transition metal is precipitated. References 3: 2 Russian and 1 Western.

USSR

UDC 621.762;669.018.29

STUDY OF CONDITIONS IN PRODUCING TWO-LAYER MATERIALS WITH TITANIUM CARBIDE-STEEL SURFACE LAYER

Ordzhonikidze IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, TSVETNAYA METALLURGIYA in Russian No 5, 1976 pp 76-80 manuscript received 10 Jun 74

KIPARISOV, S. S., NARVA, V. K., VSEVOLODOVA, L. A., Moscow Institute of Steel and Alloys. Chair of Rare, Radioactive and Powder Metallurgy

[Abstract] Materials with a wear-resistant surface layer make it possible to save hard-to-obtain materials and lower the production cost of articles.

A study was made of the feasibility of producing two-layer materials on an iron base with the addition of 1-3% copper and a surface layer consisting of 50% TiC and 50% Kh12M steel. Two-layer specimens were obtained by pressing together the surface layer and the base. The specimens were sintered for an hour at 700°C to remove the plasticizer and then sintered for an hour in vacuum at 1400°C. The specimens were subsequently heat-treated. It was determined that the strength of the bond between the layers increases with the increasing copper content in the base and decreasing pressure of the base compacting. It was also found that the heat treatment improves the hardness of the layers and practically does not affect the strength of the bond between the layers. Figures 6; references 4, all Russian.

USSR

UDC 621.762.2

INVESTIGATION OF THE FEASIBILITY OF MAKING CUBIC TUNGSTEN CARBIDE AT HIGH PRESSURES

Kiev VLIYANIYE VYSOKIKH DAVLENIY NA VESHCHESTVO [Influence of High Pressures on Matter, Collection of Works] in Russian, 1976 pp 9-14

SAMSONOV, G. V., TIMOFEYEV, I. I., KOVTUN, V. I., ALEKSEYEVSKIY, V. P., LITVIN, YU. A. and YAROSH, V. V.

[From REFERATIVNYY ZHURNAL, METALLURGIYA No 11, 1976 Abstract No 11G544 by O. Padalko]

[Text] Tungsten carbide powders with compositions $WC_{0.95}$, $WC_{0.9}$, $WC_{0.85}$ and mixtures of tungsten and carbon black with the same ratios of components were subjected to the action of static and dynamic pressures. Static pressure working was done in chambers of the "toroid" type. Impact compression was done in cylindrical ampoules, using a 40/60 fusion of TNT and RDX as the explosive. For a packing density of 7-8 g/cc of the powder in the ampoule the pressure on the wave front was $1.45-1.65 \cdot 10^6$ kg/cm². Synthesis and compression under static pressure were done at 1200°C and a pressure of 90 kbar for 30 min. The methods of x-ray structural analysis and microhardness showed the presence of cubic β -modification of WC in the form of individual grains and conglomerates of grains in the products formed under static and dynamic compression of both carbide powders and mixtures of initial components with the composition $WC_{0.95}$ and $WC_{0.9}$. No β -WC is observed in the case of compression of $WC_{0.85}$. Table 1, references 19.

USSR

UDC 621.762.3

INVESTIGATION OF THE ACTION OF SHOCK WAVES ON CARBIDES OF CHROMIUM AND MOLYBDENUM

Kiev VLIYANIYE VYSOKIKH DAVLENIY NA VESHCHESTVO [Influence of High Pressures on Matter, Collection of Works] in Russian, 1976 pp 15-18

SAMSONOV, G. V., TIMOFEYeva, I. I., KOVTUN, V. I., ALEKSEYEVSKIY, V. P., YAROSH, V. V. and POLISHCHUK, V. S.

[From REFERATIVNYY ZHURNAL, METALLURGIYA No 11, 1976 Abstract No 11G548 by O. Padalko]

[Text] A study is done on the effect that shock waves have on chromium carbide powders with bound carbon content of 6, 6.7 and 9.2%, and on Mo_2C powder. Impact compression was done in cylindrical ampules. Maximum pressure was 850 kbar for chromium carbide specimens and 1.05 Mbar for Mo_2C . The ampule with chromium carbide containing 9.2% carbon broke, and only in this case was a change in the phase composition of the initial product observed. The mixture of Cr_7C_3 (base) and Cr_3C_2 was replaced by a mixture of Cr_3C_2 (base) and Cr_23C_6 , and the $Cr_7C_3 \cdot Mo_2C$ in the center of the ampule dissociated with the formation of metallic Mo. Table 1, references 7.

USSR

UDC 621.762.4

EXPLOSIVE COMPRESSION OF A MIXTURE OF STEEL AND COPPER POWDERS

Kiev VLIYANIYE VYSOKIKH DAVLENIY NA VESHCHESTVO [Influence of High Pressures on Matter, Collection of Works] in Russian, 1976 pp 178-181

DERIBAS, A. A., STAVER, A. M., ZUYEV, A. A., MAN'KOVSKIY, V. V., SHTERTSOR, A. A. and PEREGOYEDOV, V. G.

[From REFERATIVNYY ZHURNAL, METALLURGIYA No 11, 1976 Abstract No 11G553 by O. Padalko]

[Text] An investigation is made of the properties of a steel-copper material with ratio of components of 1:1. The initial materials were powders of copper and "08" steel with granularity of 1-20 and 1-1000 μm respectively, the explosive being ammonite with saltpeter in a weight ratio of 1:1. A steel matrix is formed under impact compression. Under the action of shock waves the particles are deformed, and zones of melts, recrystallization and intensive flow are formed. In connection with the nonuniform distribution of temperatures and pressures throughout the volume of the material, the properties are also nonuniformly distributed. After explosive compression the porosity of the material was 4.1% and ultimate strength was 8.2 kg/mm^2 ; after additional sintering -- in air at $800^\circ C$ for 4 hours, the corresponding

figures were 4% and 28 kg/mm²; and after sintering in vacuum at 900°C for 2.5 hours, porosity was 10% and ultimate strength 20.5 kg/mm². The properties of the material after compression with subsequent extrusion under a pressure of 10 metric tons per sq. cm: porosity 0.6%, ultimate strength 57.5 kg/mm², yield stress 51 kg/mm², residual longitudinal extension 32%, residual lateral contraction 30%, Young's modulus 15,000 kg/mm², thermal conductivity of the material is 0.369 cm²/s, specific heat 0.102 kcal/kg per °C. Table 1, references 10.

CSO: 1842

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